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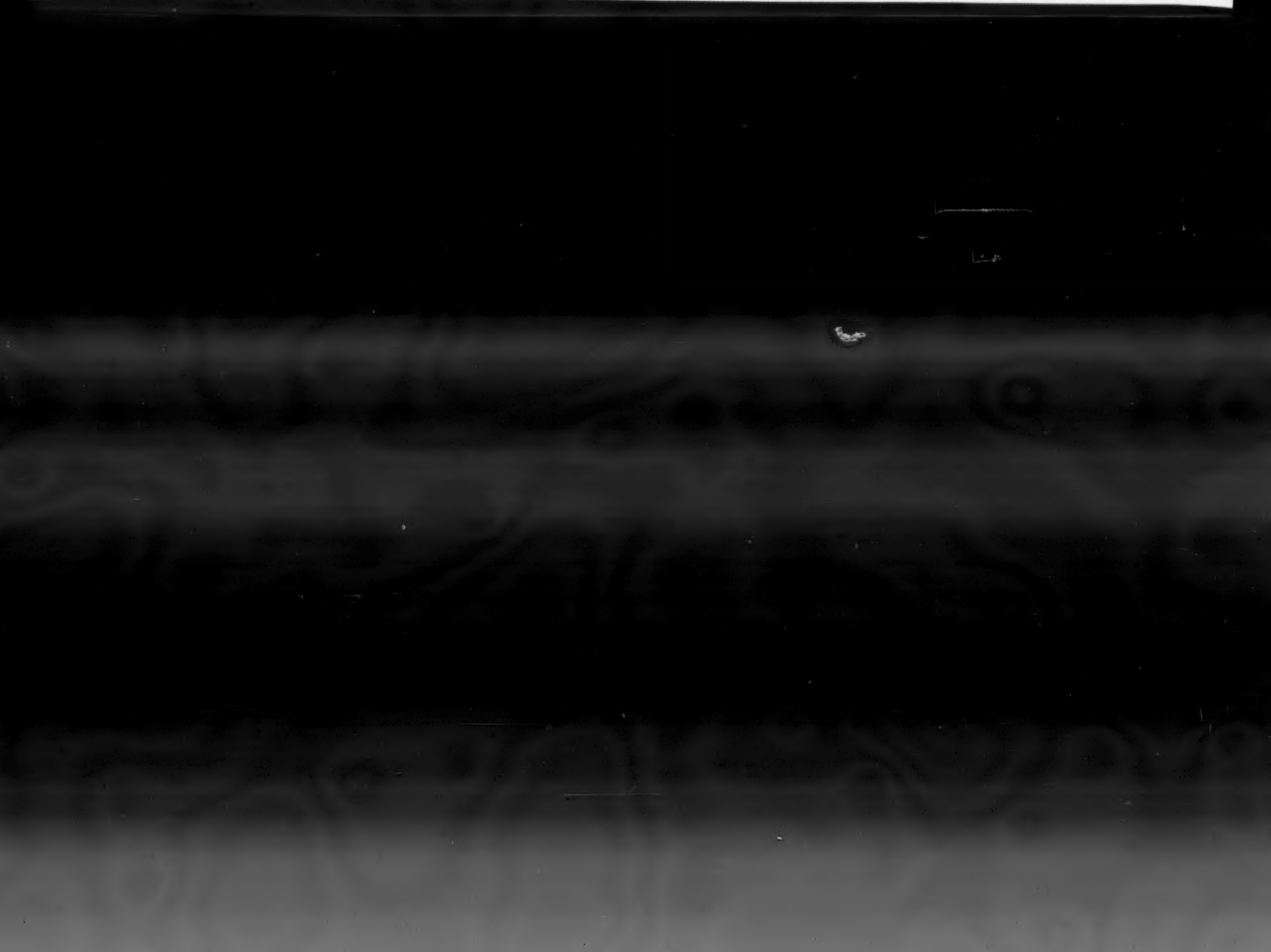

SURGERY, GYNECOLOGY AND OBSTETRICS

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PERINEORRHAPHY FOR COMPLETE LACERATIONS

BY THOMAS J. WATKINS, M. D., CHICAGO

THE older operations for complete laceration of the perineum consisted chiefly in denudation of the mucosa over the area injured and closure of the wound by rectal and skin sutures. These operations often failed, as rectovaginal fistulæ frequently resulted and infections almost invariably occurred.

Emmet's operation[1] which he published in 1873 did much to improve the results. His "purse-string suture" just underneath the rectal mucosa closed the rectal opening, diminished very much the size of the rectal wound and thus lessened perceptibly the danger of a rectovaginal fistula resulting. It eliminated rectal sutures and thus diminished to a very great extent the danger of infection. He also called attention to the dimple over the ends of the retracted muscle, denuded down to these ends, passed his sutures through them, and thus obtained coaptation of the torn ends of the muscle. He placed many of the sutures within the vaginal canal and thus also diminished the dangers of infection.

J. Collins Warren,[2] in 1878, devised the "flap operation" which has been of great importance in the development of repair of complete lacerations of the perineum. The flap was turned down from above and not only closed the rectal rent but also completely separated the rectum from the perineal wound.

[1] "Laceration of the Perineum, involving the Sphincter Ani. An Operation for Securing Union of the Muscle." Medical Record, March 15, 1873.

[2] Boston Medical and Surgical Journal, Jan. 3, 1878, and Trans. Am. Gynecolog. Soc., 1882.

He followed the advice of Emmet to dissect down to the retracted ends of the sphincter ani muscle. His flap operation lessened to a greater extent than Emmet's purse-string suture the dangers of occurrence of a rectovaginal fistula and of infection. His sutures also approximated the ends of the sphincter ani muscle.

Tait (Diseases of Women and Abdominal Surgery, 1889) did pioneer work in the development of operations for complete perineal lacerations. It was he who popularized the flap operation although his flap formation differed from J. Collins Warren's in that he dissected up the flap from below. He closed the rectal rent after the plan of Emmet by a purse-string suture, but more effectually closed the tear in the rectum as his method of separation of the rectal and vaginal walls mobilized the rectal wall and thus made it possible to bring the most distant part of the rectal tear down to the skin surface without causing much tension upon the purse-string sutures. This was so effectually accomplished as to practically eliminate the dangers of a rectovaginal fistula following the operation. The few sutures used in his operation lessened the dangers of infection and the probabilities of necrosis and suppuration. His operation was easily modified to allow of repair of the various injuries of the levator ani muscle as accomplished by the Emmet or Hegar operations. The only plausible objections to his operation were that some of the sutures were in close contact with and constricted the anus.

Fig. 1.

Ristine[3] and Kelly[4], in 1899, described an "apron" operation which was quite similar to the J. Collins Warren operation except they advocated dissecting out and individual suture of the sphincter ani muscle. The importance of individual suture of the muscle had also been emphasized by Baldy, Schoemaker, Bovcé, Noble, Dickinson, Leopold, and Le Conte.

The operation which I desire to describe to you has, I believe, the following important features:

1. The external sutures are all distant ½ inch or more from the anus and consequently minimize the danger of infection.
2. There is no constriction of the skin and connective tissue about the anus.
3. Individual suture of the muscle.
4. Absence of any danger of a rectovaginal fistula as a result of the operation.
5. A relatively small amount of suffering following the operation.
6. Enemas can be used in the postoperative treatment without the usual danger of injury or infection.

[3] Am. Journ. Obs., 1899.
[4] Trans. Amer. Gyn. Soc., 1899.

TECHNIQUE

1. A transverse yaginal incision one-half to one inch long is made as shown in Fig. 1. The incision extends through the vaginal mucosa and should be at least half an inch beyond the uppermost part of the rectal tear. The distance between the rectal tear and the incision will vary in individual cases. The higher up the incison the greater the security against infection. When there is not much injury to the rectal wall the incision may be made at least one inch above the rectal opening.

Fig. 2.

Fig. 3.

2. A sharp-pointed straight scissors is pushed under the vaginal mucosa from the incision down to the retracted end of the sphincter ani muscle on one side, and the blades are opened so as to freely separate the tissues, care being taken not to tear into the rectum. (See Fig. 1.) The end of the retracted muscle is easily detected by the depression described by Emmet. Blunt dissection with the scissors is done in like manner on the other side.

3. The connective tissue, between the two canals made by the scissors, is separated by blunt dissection or by incision down to the rectal wall, care being taken not to injure the rectum. When this tissue is separated, the finger inserted into the wound will show the absence of any connective tissue bands. (See Fig. 2.) If any bands of tissue are felt, they should be snipped with scissors. It is important to separate this tissue thoroughly as the amount of tissue left at the bottom of the wound, over the rectal mucosa, will determine the amount of traction upon the sutures that unite the torn ends of the sphincter ani muscle. The ultimate result will depend much upon the amount of tension upon these sutures. When this tissue is thoroughly separated one can readily appreciate that the amount of tension upon the sutures that unite the sphincter ani muscle will be slight, as they have to be drawn over the rectal mucosa only.

4. The end of the muscle is now caught on either side with a Pean or rat-tooth tissue forceps and drawn into view. (See Fig. 3.) The muscle is more readily brought into view when the blunt dissection is carried well down into the muscle. One should be careful to bring up most of, if not the entire muscle. The first grasp of the forcep will frequently not bring up enough of the muscle. More muscle can be brought into view by exerting slight traction upon the forcep while a second, or if need be, a third forcep catches a deeper part of the muscle.

Fig. 4.

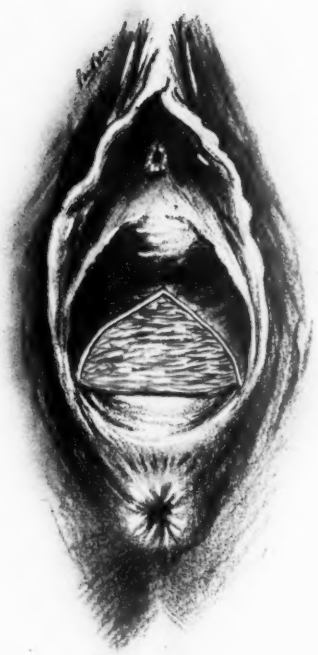

Fig. 5.

5. The two ends of the muscle are sutured with No. 1 chromicised catgut. The suture should be carried through the muscle two or three times and then tied (using only one knot). (See Fig. 4.) Should one desire to use silkworm gut sutures, the ends of the muscle could be easily approximated by a figure-of-eight suture, bringing the ends of the sutures out through the tissues on either side and tying. It is advisable to catch up the connective tissue freely about the muscle with the suture to lessen the danger of the sutures' cutting out and the muscle retracting. When the suture is completed the muscle is allowed to drop down to the bottom of the incision. A test of good approximation of the muscle is a restoration of the corrugations of the skin that normally surround the anus.

6. The remainder of the operation is the same as for relaxation of the vaginal outlet, and may be done by an Emmet or Hegar operation, according to individual preference or the extent and variety of the injury of the levator ani muscle. Fig. 5 is intended to show a Hegar denudation, and Fig. 6 shows the operation completed. Note the distance of the sutures from the anus, and also that the sutures, in favorable cases, will all be in the vaginal canal. There will be found on passing the finger into the rectum normal muscular resistance and absence of constriction of the skin about the anus.

The operation is not a "flap" or "apron" operation; it consists largely in a transposition of some of the tissues. The mucosa between the incision and rectal tear is transposed to form the external surface of the perineal body. The rectal tear is obliterated by transposing its uppermost part to the skin level.

Two objections may be suggested, namely:

1. That the operation cannot be used in lacerations that extend high up in the rectum.

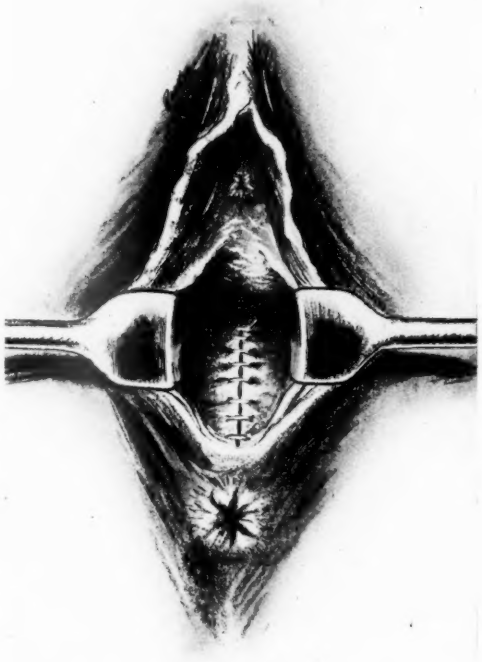

Fig. 6.

2. That the ends of the muscles are not freely dissected from the surrounding tissues.

I have not had an opportunity to use the operation in cases of high rectal tears. In the cases of extensive rectal laceration the rectum, however, can readily be loosened by separating the rectal and vaginal walls by blunt dissection, commencing the blunt dissection at the transverse incision and carrying it upwards between the vagina and rectum according to the method of Tait. There is a possibility that this may cause some bulging of the rectal walls, at the anus at either side of the tear, but from the experience which I have had I am quite certain that this bulging will not be sufficient to injure the results of the operation.

It would seem that no advantage obtains in dissecting free the ends of the sphincter, as the union of muscles is always a connective tissue union. Sutures that pass through the muscle and connective tissue are much less liable to cut out than sutures that pass through the muscle alone. I have repeatedly experienced difficulty from tearing out of sutures that included the ends of the muscle only.

I have had an opportunity to use this operation in five cases. The technique is not difficult. The muscles are easily brought into view and most of the wound, when closed, is inside the vaginal canal. The after treatment is much simplified, as enemas can be given without danger of injury or infection of the wound. There is very little danger of fæcal contamination of the wound, and consequently much less danger of infection than is usual in complete perineorrhaphies. It is practically impossible for a rectovaginal fistula to result from the operation, and convalescence is attended by a relatively small amount of suffering.

PRIMARY CARCINOMA OF THE APPENDIX—CASE REPORT

By J. J. COONS, B. S., M. D., Columbus, Ohio

History. Miss E. N., age 21, admitted to Mt. Carmel Hospital, May, 1905.

Complaint. Pain in abdomen.

Family History. Negative, except that her father's father died from a cancer on lower lip.

Personal History. Unimportant. Had scarlet fever in childhood; typhoid fever sixteen months ago; no complications. Patient claims that she has always been very healthy until six weeks ago.

Present Illness. Began one and one-half months ago with severe cramping pains in the left ovarian region; the pains have been present almost daily, and of sufficient severity to keep the patient in the house and in bed most of the time.

Physical Examination. Patient is well nourished; mucous membranes good color, not anæmic, tongue slightly coated; superficial glands of the body not enlarged; lungs and heart clear; hepatic and splenic dullness normal. Examination of abdomen shows no abnormalities, except slight rigidity and tenderness on deep pressure on left side, low down. Vaginal examination reveals a mass in left side, which is diagnosed pyosalpinx, and surgical interference advised. Cœliotomy

Photomicrograph showing growth of carcinoma in the appendix.

was performed, May 20, 1905, by Drs. W. D. and C. S. Hamilton. The left tube and ovary were removed and the appendix examined. Finding some congestion and presumably a concretion, which could not be dislodged, appendectomy was performed. The patient made an uninterrupted recovery and left the hospital in three weeks. In January, 1907, Miss E. N. was again admitted to Mt. Carmel Hospital and operated upon by the Drs. Hamilton for tubal pregnancy. No signs of metastatic involvement about the appendix could be found, and the patient is alive and well to-day, almost three years since the removal of appendix.

Pathological Report. Ovary, tube, and appendix removed. The ovary and tube are bound together in a dense mass of adhesions, about the size and shape of a duck's egg. The uterine end of tube has a normal size and appearance, except for congestion; about 3 cm. from uterus, the tube enlarges, becomes adherent to ovary. The fimbriated extremity has been sealed, forming a closed cavity containing a thick, creamy fluid. The walls of this portion of the tube are thin, the inner surface is smooth, the folds having been destroyed. The ovary is the seat of a single large abscess, which has no communication with the tube.

Diagnosis. Pyosalpinx, abscess of ovary, pelvic peritonitis.

Appendix. 7 cm. long, diameter a little greater than a "goose-quill." Peritoneal surface is smooth, contour uniform and regular, except at the tip, where there is an enlargement, suggestive of a concretion. There is a mesentery from end to end. Appendix is opened longitudinally, canal patent, no stricture or obliteration; contains a thin fæcal-like semi-fluid, no concretions, walls of average thickness. Just at the distal end of the appendix there is a round, pea-sized, nodular mass (6 mm. in diameter), which is firmly imbedded in the walls of the appendix. The tumor mass is so small that it is not cut across, but is mounted as a whole for sectioning.

Histologically. The fibrous structure of the tumor is well marked. These bands spring from the muscular coats, whose structural relations have been wholly destroyed, and run inwards into the submucosa. The epithelial covering of the mucous membrane is lost, except at one point where a gland-tubule is found on the surface. In the same field, two or three other small tubular glands may be seen, cut transversely. The lymph-nodes, like the tubular glands, have been obliterated, except at two or three points, where there are small, irregular masses of lymphoid tissue. A diffuse, small, round celled infiltration is seen throughout the new growth. The mucosa and submucosa are everywhere studded with small oval and round masses of spheroidal epithelial cells, and these cells also run in irregular bands between this loose connective tissue. In places, the nests of cancer-cells do not entirely fill up the alveoli. Few of the larger cell-masses show a very small open space in the center, containing structureless cell-debris, suggesting the origin of the new growth from the tubular glands. The distorted circular and longitudinal muscular coats of the appendix show small nests and chains of cells distributed everywhere. Cell-masses have invaded the peritoneal covering of the appendix; at one point this coat is bulged out and the loose, areolar tissue is packed with these cells. There are large numbers of small round cells in the peritoneal structure and the small blood-vessels show congestion.

Sections of the appendix half-way from tip to cæcal attachment. The mucous membrane is intact. Mitotic figures may be seen both in the tubular glands and the embryonic centers of the lymph-nodes. The lymphoid tissue is increased in amount. Clumps of round cells are scattered here and there in the muscle coats of the appendix. There is congestion of the peritoneal investment.

Diagnosis. Spheroidal-celled carcinoma of the appendix.

TRANSPLANTATION OF OVARIES

By FRANKLIN H. MARTIN, M. D., Chicago
Professor of Gynecology, Post Graduate Medical School of Chicago, Gynecologist to Post Graduate, Woman's, and Charity Hospital

ON May 15, 1903, in a paper before the Chicago Gynecological Society, I reported two cases of hetero-transplantation of the ovaries in human females with a review of the literature. The cases were subsequently published in the *Chicago Medical Recorder*. In the present communication, I wish to review briefly the two cases previously reported, and to report an additional case of hetero-transplantation, and five cases of homo-transplantation, with a complete review of the literature to the present time.

My three cases of hetero-transplantation, two reported in 1903 and one reported now for the first time, were cases in which the ovaries had been sacrificed in operations which had been performed from one and a half to two years previous to the time I attempted to give relief by operation for transplantation of ovaries from another individual. In each case an artificial menopause had become thoroughly established with exaggerated symptoms of a natural menopause which are so often complained of by young women whose ovaries have been removed.

Two of these women were extremely anxious to be able to bear children and in these two cases, (1) and (2), the tubes had been amputated flush with the uterus in the operation in which the ovaries had been removed, hence it was necessary at the operation of transplantation performed by me, to also reconstruct patent oviducts. In order that the details of my work together with the motive, may be followed and understood, I will transcribe the preliminary report of my two original cases much as it appeared in the original communication.

"In the year 1901 I received a communication from a young woman, about twenty-nine years of age, asking if it would be possible to transplant ovaries into the pelvis of a woman from whom for cause, the ovaries had been removed for dysmenorrhœa without the operator having communicated to her, prior to the procedure, the fact that it would be necessary to remove those organs. Upon learning of the fact that the ovaries had been removed, she was very much horrified, as she considered her life blighted and her matrimonial prospects ruined. These reasons appealed to her strongly because of the fact that she was engaged to be married, and since she did not menstruate she refused to take this step, unless restoration of the menstrual function were possible.

"In brooding over her strange fate it occurred to her that it might be possible to restore the function of menstruation, and her power to conceive, by having transplanted into her sterile pelvis the necessary organs taken from another woman in whom sacrifice of healthy structure might be necessary.

"The feasibility of this idea appealed to her so strongly that she finally wrote to a number of surgeons, and one of these letters was received by me.

"At that time I did not know of the work which had been done in this line by Robert T. Morris and others. I immediately began experiments which would throw light upon this interesting subject, and I soon found that a great deal of work had already been done in this direction, dating back to about 1895. Practically nothing, however, in the way of *hetero-transplantation* in the human had been attempted when this report (1902) was made. I therefore informed the patient that I would be glad to undertake the operation of ovarian grafting at any time that she would present herself and as soon as we could get a proper case from which to remove the necessary organs.

"Accordingly in June, 1902, a year after the time of her first communication and two years after the date of operation in which her appendages were removed, the patient presented herself for operation.

"I carefully explained to her the difficulties which we had to surmount, and that it would be necessary to obtain a subject from whom she was to receive her specimens in whom an operation was absolutely necessary, who could

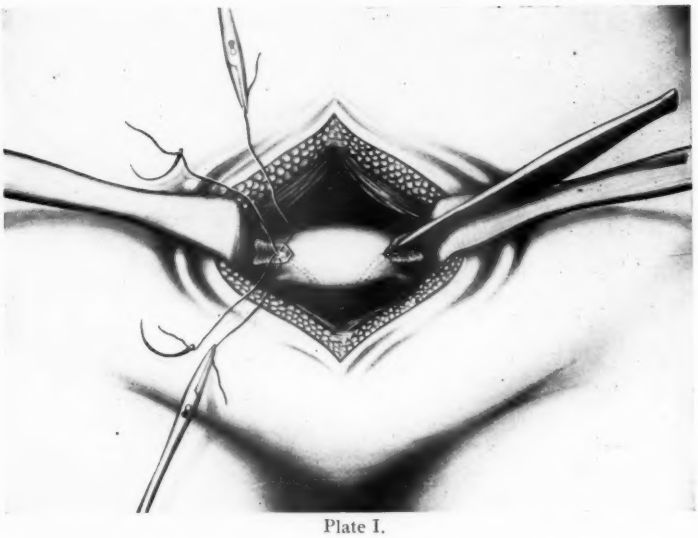

Plate I.

furnish a sufficient amount of healthy ovarian tissue for our purpose, who had no serious constitutional taint, whose age was that of the early child-bearing period, and whose race was similar to her own.

"I also clearly informed her that the operation must be looked upon entirely in the light of an experiment, and that she must be prepared to assume all responsibility with regard to failure in the outcome. Being a woman of unusual intelligence and one who was thoroughly in earnest in her efforts to regain her normal condition, these preliminaries were very easily settled. The woman obtained a boarding place near the hospital, with the understanding that she was to report for preparation for operation at any time when a prospective case which was likely to furnish proper specimens entered the hospital for operation, in order that she might be operated upon immediately following the operation performed upon her benefactor. The poor woman was prepared for laparotomy at least six times between the latter part of June and the 25th of July, before we were able to find proper material for our experiment.

HETERO-TRANSPLANTATION

"Case 1. On the morning of July 25, 1902, at the Post Graduate Hospital, I operated upon a woman thirty-seven years of age, who had borne three children, the youngest seven years old, and who had been suffering for some time from an impacted retroversion. Having previously obtained consent, I removed one third of each ovary from this woman, taking the distal third from one ovary and the proximal third from the opposite, including with the ovarian tissue a portion of the broad ligament two centimeters in width in each specimen. I placed the specimens in hot normal salt solution for preservation, after which the broad ligament and the severed portion of the ovary remaining were drawn together by a running suture of catgut.

"Removing these portions of the ovary I left intact an abundance of tissue, as the ovaries were unusually developed. The portions of the ovaries removed were approximately two centimeters in diameter with a portion of the broad ligament already referred to.

"After completing my operation upon this woman, the second patient, the subject for transplantation, was anæsthetized and a preliminary dilatation of the uterus and curettement performed in order to render sterile the uterine cavity through which it would be necessary to make a portion of my manipulations.

"I then opened the abdomen and exposed a small, atrophied uterus, measuring approximately two inches in length, including the cervix, an inch and three-quarters in width, and three-fourths of an inch in antero-posterior diameter. The tubes and ovaries were absent, and near each corner of the uterus were a few, thin, cob-web adhesions, with the slight projections of a quarter of an inch on either side which represented the remains of a Fallopian tube.

"My first accomplishment obviously was to reconstruct the remains of each Fallopian tube, so that we would have a pervious oviduct. To accomplish this, I placed in the uterus a metal uterine sound, in the

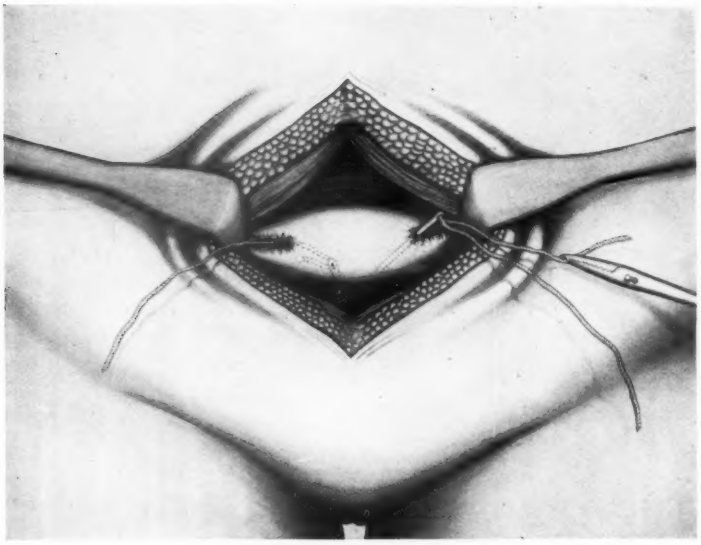

Plate II.

bulbous end of which I had constructed an eye, and this sound, with its bulbous extremity, was forced well up into the angle of the womb, opposite the impervious tube. With the sound pressed well into the corner I split the amputated tube with a scalpel, until I came to the small line marking its mucous membrane, and until the sound, pressing upon the mucous membrane of the uterus at its horn, showed through the translucent mucous membrane at that point. (Plate I, left side.)

"In order to attach the endometrium to the peritoneal coat of the uterus opposite it, I first caught, with a round needle into which was threaded a small catgut suture, an edge of the peritoneum, and then carried the needle deep into the tissue of the uterus until it impinged upon the point of the sound deep enough to grasp the mucous membrane of the uterus. (Plate I, right side of patient.)

"This manœuvre was repeated at four different points surrounding the bulging point of the sound until I was satisfied that the peritoneal coat of the uterus and the mucous membrane of the interior of the horn of the uterus were brought together, and then, between these sutures, the sound was forced through into the peritoneal cavity. (Plate II, left side.)

"The peritoneum was then attached to the line of mucous membrane of the amputated tube in such a way as to give a mucoserous canal directly into the cavity of the uterus. I then threaded through the eye of the sound a No. 4 braided silk suture of sufficient length to enable me to draw the whole silk cord through the length of the uterus and vagina and have material enough for a portion of it to project into the peritoneal cavity to the extent of one inch. The sound was then withdrawn and the suture brought out to the vaginal outlet, and a portion of it left to project into the peritoneal cavity to the extent of about three-fourths of a inch.

"I now split the broad ligament beneath the end of the amputated tube, immediately outside of the horn of the uterus, and at that point, hugging closely the tube and uterus, I attached one of the portions of ovary that I had removed for the purpose of transplantation in the following manner:

"The raw surface of the ovary was placed in the raw surface made by splitting the broad ligament, and the specimen was secured in this position by a series of eight or ten interrupted, fine, catgut sutures. (Plate III, left side.)

"The same procedure was carried out in every detail on the opposite side of the uterus.

"Before closing the abdomen the silk ligature was laid carefully in contact with the ovary, each projecting into the abdomen as has been stated, about three-fourths of an inch. I employed this ligature as an additional means of keeping patulous the newly constructed oviduct, with instructions that it be removed at the end of two weeks, unless the symptoms called for an earlier interference.

"The toilet of the peritoneum was then completed, the abdomen closed and the patient returned to bed. As every detail of the operation was new, it consumed considerably more time than would ordinarily be necessary, the patient being upon the operating table about forty minutes.

"A loose packing of iodoform gauze was placed in the vagina and an antiseptic pad applied over the vulva in order to protect the silk ligature which extended into the abdomen.

"The patient made an ideal recovery. The temper-

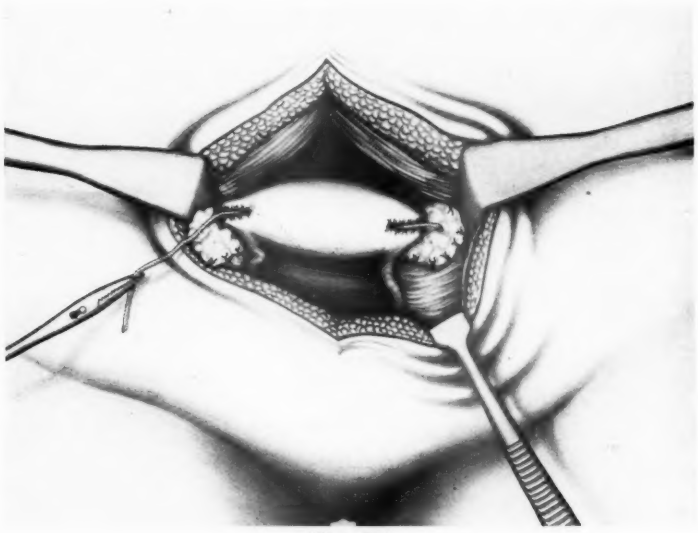

Plate III.

ature remained absolutely normal, and at no time was there any indication that irritation was resulting because of necrosis of the transplanted tissues. The patient left the hospital in the best possible health at the end of three weeks.

"CASE II. Miss A., unmarried, aged twenty-four years, a nurse by profession, presented herself for an operation for transplantation of the appendages and repair of the tubes, about the middle of September, 1902. This patient's object in submitting to the operation was primarily to be relieved of the severe nervous symptoms so frequently following the removal of the appendages. She had already submitted to two laparotomies, one of them two years previous to this date, in which one of her appendages was sacrificed; the second operation, a year and a half prior to this time, in which the appendages of the opposite side were removed. During the last year and a half menstruation had ceased and she had been subject to extreme nervousness and the well-known vasomotor disturbances described as "hot flashes" which are so often complained of in women suffering from artificial menopause. The girl was otherwise a strong, well-developed, healthy subject. She was very desirous not only of being relieved of these nervous symptoms, but of having the sexual organs so reconstructed that conception would be possible in case of marriage.

"The woman had complained too, for some time, of a severe pain in the left side, which frequently simulated partial obstruction of the bowels.

"As this patient had been acquainted with the details of the first case I operated upon, it was unnecessary to explain to her the experimental stage of the operation. She held herself in readiness and was finally operated upon on the morning of September 24, 1902.

"I obtained my specimens for transplantation by severing, as in the previous case (having obtained consent for the operation), about one-third of each ovary from a woman upon whom I operated for chronic retroversion and upon whom a ventral fixation was performed. This woman was twenty-five years of age and the mother of three children. The specimens were preserved in hot salt solution, as in the previous case.

"Case II was then anæsthetized, the uterus was thoroughly dilated, curetted, and sterilized, after which she was placed in the Trendelenburg position and I made the exploratory incision for the operation. I found the omentum and a portion of the large intestine adherent to the left broad ligament at the seat of the amputation of the appendages. By using quite a little time I succeeded in removing all adhesions and bringing the uterus, which was about an inch and a half in width, about three-quarters of an inch in thickness and two inches in length, well up into the abdominal wound. The uterus was considerably atrophied, as these measurements indicate, being about one-half the size that one would expect in a woman possessing the development of the one on whom I did the operation. Small projections, less than one-half inch in length, marked the location of the amputation of the Fallopian tubes. The tubes and ovaries had been thoroughly removed. The operation of transplantation and repair of the tubes was carried out in every detail as described in Case I.

"The patient stood the operation without serious consequences and her convalescence was ideal, with the exception of a slight temperature reaching 101 degrees on the third and fourth day. She left the hospital at the end of three weeks.

COMMENT

"In removing the portions of ovary from the salt solution where they had been lying in the interval of the operation, I was startled at their paleness and feared that their circulation would not be re-established after grafting. My uneasiness was dispelled immediately after placing their denuded surfaces in contact with the exposed surfaces in the broad ligament. They immediately filled with blood by capillary action, and became swollen and extremely pink in color. I felt confident that the severed tissue would be abundantly supplied with blood by this action, until the direct continuity of vessels was established.

SUBSEQUENT HISTORY

"CASE 1. The patient returned to her home in the early part of August, with the intention of beginning her duties as a school teacher in September. She had recovered perfectly from her operation. It would not be expected of course that she would menstruate at this early date.

"October 19, 1902, she wrote: 'I am glad to say that my general health is as good as ever. Have been able to be in the school-room every day. Would feel all right if the bloating in the afternoons did not make me feel uncomfortable.'

"October 22, 1902: 'Have felt several times, symptoms of menstruation. There has been a discharge this week resembling white of an egg. Yesterday really expected to find that I was menstruating. Was bloated so I could breathe only with the upper half of the lungs. Have had hot flashes.'

"November 16: 'Twenty-eight days since the appearance of what seemed symptoms of menstruation To-night the same symptoms appeared. Feel so full and uncomfortable.'

"December 25: 'There was apparently no change in my physical condition except sharp pains in the region of the ovaries.'

"January 20, 1903: 'For the past three days there has been pain in the ovaries, also quite profuse discharge of mucus. Also drawing sensation in vagina. Have been very much more nervous of late.'

"February 16: 'Another month has passed and the discharge of mucus is the same as before, also some pain across me. Otherwise I feel perfectly well. At these times seem to tire more easily and occasionally have old hot flashes.'

"March 20, 1903: 'I must write the same as usual. There are no further signs of menstruation than noticed in previous months. Have bloated a good deal.'

"April 19, 1903: 'Have had some pain, much itching and burning sensation in the ovarian region, but other than that there is no change from other months. Am feeling real well most of the time.'

"June 20, 1903: The patient presented herself at my office and announced that she was menstruating. The flow lasted a portion of two days.

"July, 1903: Patient writes that she has on several occasions had some slight signs of menstruation. Not normal or profuse.

"Report received April 27, 1908: The patient states that a normal re-establishment of menstruation has not occurred. 'At present I weigh about 160 pounds and feel well. *Haven't been inconvenienced with hot flashes since the operation.* There is no vaginal discharge.'

"CASE 2. Near the middle of September 1902, was the date of the operation on the second case.

"One month after the operation I saw the patient in my office and she expressed herself as being in good health and asked me it it were possible for her to have menstruation in so short a time. This question was prompted by the fact that she had had a week of sensations similar to those she formerly experienced as premonitory to menstruation.

"December 17, 1902, three months after the operation, the patient reported at my office and said that for one week she had had a full feeling in the pelvis and pain in the side and some free mucus discharge from the vagina.' She also felt depressed.

"February 20, 1903: Patient having gone out of the state, wrote: 'Have a little piece of news which I think will interest you. I have been having more discharge than usual this week, and on Wednesday found a little color, but the pain was almost unbearable. I don't believe that I ever had such a backache in my life.'"

I have not received a direct personal report from this woman since above report. Indirectly I have heard about her but, unfortunately, nothing further in regard to menstruation.

HETERO-TRANSPLANTATION NOT PREVIOUSLY REPORTED

CASE 3. Miss X., aged about 38 years. In January 1905, eleven months previous to the time of the present operation, the tubes and ovaries had been removed in an operation for dermoid cysts. In the removal of the appendages the tube of the left side was left intact. In the operation for transplantation, the right broad ligament was found to be adherent to the head of the colon. The omentum and several coils of small intestine were adherent to the side of the previous laparotomy wound, in the midst of which was an adherent inflamed appendix. The adhesions were carefully separated and the appendix removed. The fundus of the uterus was then drawn well up into the wound and the right broad ligament between the stump of the impacted tube and the right ligament was split longitudinally to the extent of an inch. This opening was separated with a tenaculum exposing and uncovering the subperitoneal tissue of the broad ligament representing a denuded surface an inch in length and three-quarters of an inch in width. Upon this denuded surface was placed a thin portion of oöpheron of an ovary, which had been removed from another patient within an hour and which had been preserved in a hot normal salt solution, in such a way

that its cut surface was applied to the subserous denuded area of the broad ligament. It was then attached at its edges to the cut surfaces of the peritoneum surrounding it by interrupted catgut sutures.

The ovary was split in such a way that in thickness it was not more than one-eighth of an inch at any portion, giving it in this way a broad base for its blood supply. Upon the left side, through a smaller opening between the broad ligament and the tube, a graft of a similar character was made within a quarter of an inch of the uterus in such a way that the tube would lie above it. A third graft was made in a similar manner parallel to the long axis of the uterus in the anterior portion of the fundus, extending from just below its crest in the direction of the bladder. In this case the graft was made directly upon the subperitoneal muscular tissue of the uterus. The uterus was then placed in its normal position, the omentum drawn well down behind it, and the abdominal wound closed in the usual way. The uterus exhibited an atrophied condition, being about two-thirds the size of a normal uterus.

SUBSEQUENT HISTORY OF CASE III

This patient left the hospital about three weeks after the operation. Her convalescence was practically ideal.

May, 1906, five months after the operation, the patient in a letter states that she has not been relieved of the nervous symptoms, that the hot flashes have not ceased. There has been no menstruation but some vaginal discharge.

I have not been able to elicit a further report.

HOMO-TRANSPLANTATIONS

CASE 1. Miss M., age 23 years, colored. Operated upon October 8, 1902. Double pyosalpinx. Both appendages including ovaries were removed. The appendages were sacculated and universally adherent. A thin portion of the right ovary was resected from the mass and implanted in the broad ligament beneath the end of the amputated tube which had been severed about an inch from the uterus. The denuded surface of the resected ovary was implanted beneath the peritoneum at the uterine end of the broad ligament and into the uterine tissue itself by means of four or five interrupted fine silk sutures. The tube was split and an attempt made to sew the peritoneal surface to the mucous uterine surface in order to preserve the oviduct. No attempt was made at transplantation or preservation of the tube upon the left side. The uterus was then suspended.

A report one year and two months later, December 1903, records menstruation regular.

CASE 2. Miss M., age 22 years. Operated on January 12, 1903, for bilateral disease of the appendages complicated with retroversion. The appendages were found much enlarged, sacculated and adherent, and full of a thin pus. They were enucleated, and, as they seemed to be beyond all possiblity of repair, were removed. After carefully inspecting the specimen, upon its removal, enough normal ovarian structure was discovered by which means a transplantation might be successfully accomplished. Two portions of the tissue, each very thin and not to exceed one-half an inch in diameter, were implanted in the horn of the uterus and the broad ligament near the horn in the left side. The stump of the tube on this side was split and the hæmostasis secured without a constricting ligature surrounding it, in order to favor if possible the establishment of a patulous tube. The uterus was then suspended with a strip of peritoneum.

The patient had a perfect recovery and has remained in perfect health; has taken a nurse's training and has menstruated with perfect regularity and normally ever since.

CASE 3. Mary Y., age 17 years. Operation March 23, 1903, for ventral hernia, following an operation performed by another operator one year previous. The tubes and ovaries of both sides were infected and thoroughly adherent in the cul-de-sac of Douglas with a retroverted uterus. In the attempt to separate the adherent organs, both ovaries were found to be cystic. The cysts contained considerable straw-colored fluid. At first it appeared that both ovaries were entirely destroyed and the cysts were removed. Upon investigation of the tubes, it was found that each had a normal fimbriated end. Close examination was then made of the cystic ovaries. At two points on the cysts a thickened portion indicated considerable normal ovarian structure. This was very carefully dissected from the cysts when the ovarian tissue from each appeared as flat discs of ovarian structure. These were placed in normal salt solution and later transplanted at the top of each broad ligament near the horn of the uterus as near the normal position of the ovaries as possible. Each disc of ovarian tissue was divided into two portions and implanted with its denuded surface beneath the peritoneum after stitching that membrane in such a way as to have the surface of the ovary project above it, fine interrupted silk sutures, about four to each piece, being employed. The uterus was suspended well forward on a strip of peritoneum.

A report on December 9, 1903, eight months after the operation, gave a scant but normal menstruation. June 1, 1908, normal menstruation. Been married 2 years. Thinks she had miscarriage 2 months ago.

CASE 4. Mrs. E., age not given. Operated upon September 7, 1907. Laparotomy for parovarian cyst the size of an orange on the left side, complicated with a double pyosalpinx with general adhesions. The cyst was enucleated and the appendages removed. From one of the diseased masses was dissected a portion of normal ovarian structure. It was about the size of a quarter and about one-quarter of an inch in thickness. This was implanted in the right horn of the uterus.

Transplantation was made by applying the denuded surface of the thin disc of ovary to the muscular tissue of the uterus beneath the peritoneum by means of interrupted pyoktannized catgut sutures. The uterus was suspended by a strip of peritoneum.

CASE 5. Mrs. C. S. Z., age about 35 years. Operated upon October 30, 1903. Diagnosis: Large double pyosalpinx with tender appendix. Laparotomy revealed very large sacculated tubes involving the ovaries and a cyst of the right broad ligament with an elongated appendix attached to the pyosalpinx upon the right side.

In attempting to enucleate the mass of pathology, quite a large quantity of pus was evacuated. The tubes and ovaries were removed in mass, the cyst of the right broad ligament enucleated and the appendix removed. The uterus was allowed to remain and was of about normal size. Examination of the specimen showed a portion of the normal ovary upon the right side. This was dissected off and implanted in the right broad ligament at the horn of the uterus. This was done by burying the flat disc representing the ovary in an incision through the peritoneum on the horn of the uterus on the right side, and securing it with four interrupted silk sutures. The uterus was then suspended upon a strip of peritoneum in order to prevent its falling into the cul-de-sac and becoming adherent to the denuded peritoneal surface.

This patient after the two months of convalescence has menstruated with the exception of a period of four months, when she declared herself pregnant. This cessation of menstruation was terminated by considerable flowing at the end of four months, since which time the woman has menstruated regularly.

REMARKS ON CASES

HETERO-TRANSPLANTATION

My three cases of hetero-transplantation gave three excellent opportunities for observing the behavior of ovaries carefully transplanted from one human female to another where a complete artificial menopause had become established because of the absence of the ovarian structure.

In cases I and II there was unquestionably a revivifying influence upon the menstrual apparatus. This was shown by the appearance of vaginal discharge at intervals of thirty days for a considerable period and the discharge of blood on several occasions and in the prompt elimination in Case I of the nervous symptoms which are observed in a menopause.

Case III unfortunately has neglected to report.

I believe more ideal results could be expected if the transplantation in these cases could have been done sooner after the primary removal of the ovaries, before all the effects of the ovarian secretion had been eliminated from the patient's tissues and thereby terminated the rhythm or habit of menstruation and thoroughly established the changes of the menopause.

HOMO-TRANSPLANTATION

Four of the five cases of homo-transplantation reported regular and apparently normal menstruation. The other case did not report after the operation.

In each case the appendages were so hopelessly diseased that the ovaries were removed entirely. In each case an extremely thin portion of ovarian structure was obtainable from the sides of cysts or infected sacculated structures, with which to accomplish the graft. In the four cases reporting, the menstruation was not interrupted. These cases will illustrate what can be accomplished in the most desperate cases in maintaining the menstrual life of women who have operations for complicated pelvic pathology which requires the complete removal of the ovaries.

In three of these cases in which examinations were made subsequent to the operation, there was noticed no indication of the atrophy of the organs frequently noticed after castration with subsidence of menstruation.

LITERATURE

Dr. Robert T. Morris, of New York, was the first to make a clinical report on the subject of transplantation of the ovaries. In the *New York Medical Journal* of 1895, he published his first observations on this subject and later in the *Medical Record*, January, 1901. He also published an article in the *American Journal of Obstetrics* in 1903, and finally an article on A Case of Hetero-plastic Ovarian Grafting Followed by Pregnancy and Delivery of the Living Child in the *Medical Record*, 1906.

Morris' work is extremely interesting and suggestive and his articles must be carefully perused in order that his work may be appreciated.

In 1903, he made the statement that "ovarian

grafts from one human to another, or hetero-transplantation, undergo fatty degeneration within a year." He recommends, however, hetero-plastic work in such cases to prevent precipitate menopause. At this time he was experimenting on rabbits in order to immunize the animal against the serum of the other, claiming that an antagonism existed between animals even of the same species.

In his article of 1906, he reports a pregnancy after a hetero-plastic implantation in a woman four years after the operation had been performed. He suggests that this case was probably one of coincident tolerance of the serum of one patient for the tissues of another.

Dr. Emil Knauer (1), beginning in February 1895, and covering the period up to 1899, conducted two series of experiments upon animals, one series of twelve experiments dealing with transplantation of the ovarian tissue into the original bearer of the ovary and the other series dealing with the transplantation from one animal to another. Knauer gave to these two operations the names respectively, of homo-plastic and hetero-plastic operations.

In his first group of twelve experiments he ligated off the ovaries, transplanting these in part into the mesometrium or the peritoneal fold covering the horn of the uterus on the same side of the body, and in part between the fascia and muscles of the abdominal wall. By these experiments he showed that the ovary persisted in its new locality, and that it was not only nourished there, but that it performed its functions, that Graafian follicles were developed and that ova were expelled which were shown to be capable of impregnation. He further reports that the transplanted ovaries maintained their functions for years after the operation. By careful microscopical examination and tests of the organs after the animals were killed, he also showed that the uterus and genitalia underwent no atrophy after the operation of transplantation.

In his second group of thirteen experiments upon sixteen animals, where the tissue was transplanted from one animal to another, he reports his results as not conclusive, but subject to further experiment.

Only two of these cases were what he calls partially successful. These two certainly would not be looked upon as being very conclusive. In the first the animal was killed in three weeks and the ovarian graft was discovered in an active condition. This, he said, might be criticised as a rather short interval to allow of conclusions, but stated that if degeneration took place at all, he believed it would be early. The second animal was killed in one and one-half years. On microscopic examination no ovarian follicles were found. In this case the breasts and genitalia were atrophied.

In spite of these unfavorable results, the author believes that hetero-plastic implantations can be made successful.

Knauer found new vessels in the transplanted ovaries as early as four days after the operation. At first after the grafting, the ovaries became smaller, but later increased in size. New formation of true ovarian substance may actually occur.

Woldermann Griegorieff (7) made his experiments upon twelve rabbits, performing the homo-plastic operation and transplanting the ovary of each side to the broad ligament of the same side near the uterine cornu, and showed that ovulation and conception may occur as in the normal rabbit. In post-mortem the ovaries were found normal, with Graafian follicles visible.

J. Jayle (8) made a series of ovarian grafts, covering transplantation from one rabbit to another, and from rabbits to guinea pigs, and vice versa, but does not state his results.

Frank (9) made a series of experiments upon three patients, two with double pyosalpinx and one with cystic degeneration of the ovary — the first case, a young girl of twenty years; the second a married woman of twenty-eight years with right hydrosalpinx and cystic degeneration of the ovary; the third a woman of twenty-five, married, no children, and with double pyosalpinx. Parts of sound ovarian tissue from each patient were implanted into the uterus or the stump of the oviduct. Menstruation reappeared in all three in normal fashion, and conception in one case, but the patient aborted.

Arendt (11), of Berlin, made fifteen experiments upon nineteen animals. Eleven times he transplanted the ovaries to the ligamentum

latum in the same animal, on the same side, or exchanged the sides; twice he transplanted the ovary of one rabbit to the broad ligament of another, and twice the ovary of a rabbit to the ligamentum latum of a cat, and vice versa. The transplantations were followed by the atrophy of the entire genital apparatus, including the transplanted ovaries, showing that transplanted ovaries may grow in a new locality but that they become atrophied, as well as the uterus and cornu, in a short time (six to twelve weeks in these cases).

Hugo Ribbert (12), of Zurich, reports experiments upon guinea pigs. After thirty days, he found that the germinal epithelium, the tunica albuginea, and the upper surface layer with the primordial follicles were still vital and even showed proliferations. Transplantation was done upon the broad ligaments. In animals killed one hundred and fifty days after the operation, there was no sign of atrophy of the ovaries, but the organs were functionating and ova were found. He found new vessels in the transplanted ovaries as early as four days after the graft had been formed.

E. F. Fish (13) experimented upon rabbits, making twenty successful implantations, and says: "A series of experiments, begun in December 1896, and still being continued, shows that in the lower animals at least, if done under aseptic precautions, transplanting the ovary from one to another is unattended with the dangers we would expect. I had hoped . . . to prove that the function of the ovary would be re-established and the conception would follow. Sufficient time has not elapsed to prove or disprove anything more than that the operation of transplanting the ovary in the lower animals is as free from danger as normal oöphorectomy, unattended by pyrexia or any delay to rapid convalescence.

N. Marchese (14), (53), Palermo, Italy, transplanted the ovaries in rabbits and female dogs and exchanged the ovaries in two pairs of female dogs, All the rabbits died, but of the dogs only one died of peritonitis. In another the ovaries were found necrotic three months and ten days later. In the third dog, which was killed three months later, one ovary was necrotic, the other was normal but contained no Graafian follicles.

H. Rubenstein (15) from twelve experiments upon rabbits, in seven of which the ovary was left free within the peritoneal cavity, and in five of which it was sutured to the peritoneum, drew the following conclusions:

First: That whenever an ovary was successfully transplanted the uterus remained normal and showed no tendency to atrophy, but where the ovary was absorbed, atrophy of the genitalia followed. The uterus presented the same aspect as that of atrophy caused by castration, that is, atrophy of the muscularis and mucosa, thickening of the vessels, and proliferations of tissue in all the layers of the uterine wall.

Dr. A. Palmer Dudley (16) read before the International Gynecological Congress at Amsterdam, a paper in which he reports a case of homo-plastic implantations of the ovaries and describes in detail his method. (See article 17.)

J. H. Glass (19) reports the following case:

"Case 1. Miss S. C., by occupation a housemaid; age thirty-nine years; applied for treatment May 9, 1898, two years before having had a double oöphorectomy for a somewhat indefinite condition. The menopause supervened promptly, the sexual instinct being diminished and soon lapsing completely. The nervous symptoms so frequently following the menopause were soon present, characterized by marked mental depression, insomnia, giddiness, palpitations, heat flashes, perspirations, pelvic pains, and constipation. Nutrition was impaired. She was chloranæmic and incapable of the exertion incident to her usual occupation.

"Examination demonstrated the uterus somewhat smaller than normal, flexed and fixed posteriorly. On May 11, 1898, an operation was performed in which the uterus was disengaged and suspended to the abdominal wall, in front, the raw surface being carefully covered with peritoneum. At this time was explained to the patient the possibility of transplanting ovarian tissue into her pelvis from that of another patient. Soon after, the following case came under observation which seemed a favorable case for furnishing new material: Mrs. A., age seventeen, married, no children living, was delivered of a dead child one year before. The pelvic canal was found inadequate to the delivery of a viable child, and it was explained to the patient that childbirth by the natural route would be impossible, and only possible through Cæsarean section. As the patient shrank from this alternative, it was recommended that the ovaries be removed for the purpose of preventing conception. Under the circumstances the patient readily consented to the transplantation experiment.

"On May 14th, or three days after the operation upon Case 1 for suspension of the uterus, this case together with Case 2 was anæsthetized and brought to the operating room together. Resection of the tube and amputa-

tion of the ovary in Case 2 were rapidly performed, the healthy ovary being placed in gauze kept moist in warm normal salt solution between the times of its amputation and its implantation into Case 1, which was accomplished by incising the vagina and connective tissue down to the cervix, which was stripped up to the peritoneum with the finger, which membrane was carefully raised from its attachments to a point approximating the normal position of the ovary. All oozing was controlled by compresses wet in hot salt solution, and the amputated ovary anchored in a position by closing the canal through which it was introduced by two tiers of fine catgut and the vagina was left lightly packed with gauze.

"The recovery was reported as uninterrupted. From a short time after the operation until the present time, the patient reports to have positive sexual impulses. Sixteen days after the transplantation, menstruation occurred and lasted two full days. No recurrence of the menses followed, however, until December 22, last (1898), when she again menstruated, the flow continuing three days, being natural in color and consistency, and accompanied by a little pain. At this time, nearly eight months after the transplantation, the patient has apparently regained her mental condition, and says she is well, a statement apparently borne out by her deportment, good color, and general healthy appearance."

In a note to this paper, the author states that the patient again menstruated in February, 1899.

James F. McCone (21), in a very able paper, draws the following conclusions:

1. Contact between the ovary and tube is not essential for conception. This was demonstrated by a case which he reports as follows: "October 3, 1898, in a large white female rabbit, the left ovary was completely removed, and the right tube firmly ligated with sterilized silk. For a while the rabbit repelled the efforts of the buck to coitus. Ten months after the operation the rabbit gave birth to one well-formed offspring. Post-mortem showed the following results: The right ovary was large and functionating. There was no ovarian tissue on the left side. Injection demonstrated the patency of the left tube and the occlusion of the right."

2. Ovaries grafted from one part of an animal to another part of the same animal continue to grow and functionate and pregnancy can and does occur. He reports the following experiments for demonstration of this point: On October 30, 1898, in a large female rabbit both ovaries were removed. He planted the raw surface of one ovary into the denuded pocket of the right mesosalpinx. Seven months after the operation the rabbit gave birth to three well-formed rabbits. In the post-mortem there was found no excess of abdominal or pelvic fat. Uterus and tubes enlarged. The grafted ovary flourished in its new site. It was large and presented several maturing follicles. The dark corpora lutea were well shown. Illustrations accompany this report.

3. An ovary grafted from one animal to another of the same species continues to functionate, maintains normal conditions of tubes and uterus. Pregnancy may occur. Experiment: December 20, 1898, the author castrated a large white female rabbit. He then grafted the ovaries of another rabbit, one into a pocket in the broad ligament, the other into a pocket of the omentum. Four months later the rabbit gave birth to five well-formed offspring. In this case he had successful pregnancy four months after complete castration and transplantation from another member of the same species.

4. Ovaries grafted from one species to another continue to functionate, and seem to prevent the post-castration atrophy of the tubes and ovaries. Experiment: December 23, 1898, he completely castrated a large black female rabbit. He then implanted the ovaries of a bitch, one into a pocket of the mesosalpinx, the other on the denuded surface of the omentum. Three and a half months later, he post-mortemed the same rabbit. The deposit of abdominal and pelvic fat was not excessive. The uterus and Fallopian tubes were large and healthy. Both ovaries had continued to functionate, as was shown by the healthy maturing Graafian follicles. Photographic illustrations accompanied the report of this experiment.

5. The best results were obtained where the raw surface of the transplanted ovary was sewed to a denuded surface.

W. Preobrashenski (21) obtained only negative results when he transplanted the ovaries of six female rabbits into the abdomen of six

male rabbits. The right ovary was extirpated, together with a piece of peritoneum and sutured into the excavatio vesicorectal of a male rabbit. After five months the rabbit was killed and no trace of the ovary could be found. The same result was obtained in five other like cases which he experimented upon.

Later (22) he experimented with thirty-seven rabbits and eleven cats, as follows:

1. Transplanted both ovaries from one animal to another of the same kind, after extirpation of both ovaries.

2. Transplanted ovaries, conserving the ovaries of the second animal.

3. Transplanted the ovary to the broad ligament after extirpation of uterus and the adnexa in the same animal.

4. Transplanted ovary with resection of the uterine cornu.

5. Transplanted the ovary from a cat to a rabbit, and

6. Vice versa.

7. Grafting into mesometrium in same animal.

Results in this series of experiments were negative, except in the first case.

Joseph Halban (24), after a review of the previous literature on the subject, reports his own experiments on eight guinea pigs recently born, performing the following operations:

First animal: Extirpation of both ovaries and then subcutaneous transplantation.

Second animal: Same operation.

Third animal: Castration without transplantation.

Fourth animal: Same operation.

Fifth animal: Extirpation of both ovaries and transplantation in mesenterium.

Sixth animal: Castration and suturing of ovaries of fourth animal subcutaneously.

Seventh animal: Castration and the testicles of a male guinea pig used to replace the ovaries. One testicle is subcutaneously implanted, the other is buried in the mesenterium.

Eighth animal was not operated on, but served for controlling purposes.

These operations took place at the end of November 1897, and were published in 1900.

Halban's conclusions are as follows: "My experiments show that transplantation of well-developed ovaries is not only successful, but that it is also possible to transplant the organ of new-born animals."

The experiments also show that the Fallopian tube grows under the cutaneous layer and preserves even all of its most delicate features (ciliated epthelium).

In another report (25), where he used for his experiments four monkeys, he extirpated the ovaries and implanted them subcutaneously. Two menstruated, the other two did not. One became tuberculous and in the last only a very small particle of ovarian substance was growing. In the first two animals which menstruated, menstruation ceased as soon as the transplanted ovaries were removed.

P. Mauclaire (26) passes in review the whole literature up to 1900 and concludes by saying that the ovary may be transplanted into different parts of the body with success. One may make auto-grafting or hetero-grafting. The ovary implanted in the peritoneal cavity may produce ova, which may become impregnated and continue its external secretion.

In several cases he engrafted the ovary into the abdominal wound or under the skin in cases of salpingo-ovaritis. In seven cases of auto-grafting, four had to be removed because they were not aspetic. The three others were left and after three months one could locate them, although they had become smaller.

Grafting could be done even after the menopause, and will be of a certain advantage to the patient.

All graftings are successful, if the implanted ovary is aseptic.

These graftings may modify menstrual troubles and obviate the insuffiency of the ovaries after uni- or bi-lateral ovariectomy. In cases of fibroma or cystic salpingo-ovaritis, if the ovary cannot be left in the abdomen, one may try subcutaneous grafting.

Herlitzka (27) made forty experiments on rabbits and the same number on guinea pigs, planting the ovary in some cases in the female and in others in the male peritoneum.

His paper has a strictly biological character and he calls attention to the following points:

In homo-plastic transplantation the adult ovary grows, while in hetero-plastic grafting it degenerates either in part or completely.

Some of the tissues subjected to destruction

preserve their proliferative power in a certain degree and show karyokinetic features.

The tissues which surround the transplanted ovary and the rapidity of formation of new vessels is in a certain proportion to the degeneracy of the different tissues.

The author says that to-day it is admitted by all biologists that the different cells are not independent elementary organisms.

Amico-Roxar (28) conducted a series of experiments and found: First, that ovaries transplanted from one spot to another in the same animal grow under favorable conditions, and that impregnation and parturition may be possible; Second, transplantation from one animal to another of the same species was possible, and that the transplanted ovary would receive nutrition and perform its functions in producing healthy normal ova. His experiments on sheep, in which castration was followed by ovarian transplantation, did not exhibit those changes in the organic metabolism which were seen in cases of ovariectomy.

Monprofit (29) performed seven operations which were completely successful and draws the following conclusions from his work:

1. Transplantation may be carried out with ovarial rests of the same woman, if one keeps at least one small healthy particle of diseased ovary, or with ovaries of another healthy woman who was shortly before operated upon.

2. Implantation is to be made in the following localities: Uterine fundus (mucosa), interior surface of Fallopian tube, or the broad ligament in the neighborhood of the uterus.

This operation, says the author, is indicated in anomalies of the ovaries, in insufficiency of function, and finally as prophylaxis to prevent climacteric disturbances or sequelæ to castration.

W. J. Lukaschewitsch (30) conducted a series of experiments on animals, beginning his experiments in 1897 and killing the animals after three years. He extirpated both ovaries, following this by suturing one ovary taken from another animal, and arrives at the following conclusions:

1. One can transplant the ovary of one animal to another, both of whose ovaries have been lost, even grafting from a carnivorous to a herbivorous animal and vice versa.

2. The transplanted ovaries grow, receive nourishment, and partly perform their functions.

3. To get a favorable result one has to observe the following points: (*a*) Operation must be aseptic; (*b*) Careful suturing on the mesovarium; (*c*) Transplantation of both ovaries; (*d*) Suturing close to the locality of the extirpated ovaries; (*e*) Avoid the pressure of neighboring organs on the ovary, and also the passing of sutures through the ovary.

4. The function of the transplanted ovaries is not of long duration and the ovaries incline to senile atrophy.

5. This short duration may be explained through insufficient nourishment.

6. Notwithstanding this, well-fixed ovaries on the broad ligament prevent in a few years the atrophy of the genitalia and the tendency of the body to fatty degeneration, and have a good influence upon the general healthy condition of the animal.

7. Impregnation (pregnancy) was not observed in any of the cases, although there was coition.

Foa (31), of Turin, Italy, makes a thorough review of the previous literature, and, summing up the results of his own experiments, gives the following conclusions:

The embryonal ovary grows, whether implanted in the very young or in adult rabbits. It performs its functions, although it may be transplanted far from the site of its normal position.

The possibility of migration of the ovum in the uterus from points at some distance from the original position has been demonstrated.

The embryonal ovary implanted in a male organism conserves for a short time its embryonic structure, then it begins to develop, but after a period, which may vary from ninety to one hundred and seventy days, atrophy sets in until complete reduction has been reached.

The author does not give the number of experiments from which these conclusions are drawn.

He also found (39) from animal experiments that transplanted ovaries are changed in character according to the age of the host — for example, when grafting on an old animal, they degenerate and are absorbed, but upon the

young adult animals they become fully developed.

W. R. Nicholson (35) gives a very complete review of the literature of transplantation of the ovaries. He reports formally no cases and gives no results of experimental work. His article is extremely interesting, however, and must be looked upon as a classic on the subject.

His deductions are as follows:

First: That there is no doubt that in the rabbit the ovaries can be successfully transplanted.

Second: That they may be placed on muscle or on peritoneum.

Third: That they will not only be nourished, but will functionate.

Fourth: That pregnancy and parturition are normal, that the young are suckled and the young are normally developed.

Walter Schultz (37), of Königsberg, makes two reports, in the first of which he experimented with transplantation of the ovaries into both the male and female peritonea of guinea pigs. In one case, where the ovary was implanted in the male peritoneum of a guinea pig, after one hundred and seventeen days the transplanted organ was found attached to the abdominal wall of the male animal, like a small nodule with a smooth surface. The follicles found in the organs planted in the male were smaller than those planted in the female, and the author cannot say whether or not ova were expelled from the ovaries implanted in the male abdomen.

In a second article he records the following experiments:

1. Transplanted ovaries into the same animal.
2. Transplanted ovaries from one animal to another of the same species.
3. Transplanted ovaries into male animals.
4. Transplanted ovaries from one animal into another of a different species.

Results were as follows:

(*a*) Ovaries transplanted in other females of the same species may expel ova and form corpora lutea.

(*b*) Ovaries implanted in male animals of same species may develop up to the forty-second day, forming normal ova, and these ova were found even as late as one hundred and seventeen days after the operation.

(*c*) Ovaries transplanted from one female to another of a different species do not show any difference during the first eight days from those of the same race and species.

Out of twelve cases, the author nine times had well-preserved ova and follicles, of which some (in four cases) were found even after six to eighteen weeks.

Cramer (40) reviews Morris' work and reports two cases of homo-plastic graft. He cuts strips off of the sclerotic ovaries, splits the broad ligament, and partially buries the ovarian tissue under the peritoneum bringing the raw surfaces together. One of his patients menstruated regularly after the operation but the other did not. In his article, he makes the statement that Morris, Glass, and Dudley claim to have had pregnancy in the human being after ovarian graft.

Basso (41) in his article summarizes the work of most of the writers on this subject and gives results of a series of experiments of his own. His experiments were carried out on guinea pigs and rabbits. He buried pieces of ovarian tissue under the posterior layer of the broad ligament, in the horn of the uterus, between the peritoneum and psoas muscle, and in the anterior abdominal wall. He found that in nearly all cases of homo- or auto-plastic graft, the ovarian tissue was nourished and would functionate for a variable time, from four months to four years. His success with hetero-plastic grafting was negative.

Carmichael (42) transplanted 21 ovaries in rabbits with 6 failures, that is, the ovarian tissue did not live in the graft and he doubts that absorption of the transplanted tissue is due to action of the blood serum, as suggested by Morris, but thinks it is more a matter of local condition. He found in his cases that considerable degeneration occurred in all, especially when the whole ovary was transplanted. Intramuscular transplantation was more successful than subperitoneal. Degeneration occurring in these cases is more marked in the central portion of the graft that is the ovarian stroma. In some cases he found Graafian follicles became cystic and the ovary appeared as a multilocular cyst. He admits the power of ovulation but doubts the continuance of internal secretion. He makes the state-

ment that pregnancy has been recorded by Gordon, Doran, and others after double oöphorectomy where no transplantation was done.

Guthrie (43) carried out a series of experiments on chickens to determine the influence of the foster mother on the young in cases of ovarian exchange. He exchanged the ovaries of black and white leghorn hens and, using a control, found that the color of the chickens was decidedly influenced. He concludes that transplanted ovaries functionate in a normal manner and that the color characteristic of the chicks is influenced by the foster mother.

Magnus (44) transplanted the ovaries of 25 rabbits to determine the influence upon the young. Eleven of his grafts were successful. He found that adhesions interfered in many cases with gestation. Three rabbits gave birth to young and he concluded that at least the color was markedly influenced by the exchange.

CONCLUSIONS

FROM PERSONAL EXPERIENCE AND FROM THE REVIEW OF LITERATURE

1. The operation of homo- or hetero-plastic transplantation of the ovaries in women, or in lower animals, is no more dangerous if accomplished aseptically than any other small plastic operation on the appendages. (Morris, Dudley, Fish, Griegorieff, Frank, Arendt, Ribbert, Rubenstein, Glass, Mauclaire, Amico-Roxar, Monprofit, Foa, Knauer, Martin.)

2. Homo-transplantation of ovaries on women, or in lower animals, will prevent the atrophy of the genitalia which usually follows castration. (Morris, Fish, Dudley, Griegorieff, Knauer, Lukaschewitsch, Foa, McCone, Mauclaire, Martin.)

3. It is not yet satisfactorily demonstrated that hetero-transplantation of the ovaries in a considerable number of cases will give permanent relief from the nervous symptoms produced by the menopause or prevent atrophy of the genitalia otherwise following castration. (Basso, Martin.)

4. Hetero-transplantation of ovaries in women, or in lower animals, may prevent the atrophy of the genitalia which usually follows castration. (Glass, McCone, Mauclaire, Schultz.)

5. Transplantation of ovaries from one species into another may result in preventing the ordinary changes in the genitalia resulting from castration. (McCone, Lukaschewitsch, Schultz.).

6. Menstruation will continue in women and monkeys after homo-plastic transplantation of ovaries. (Morris, Glass, Dudley, Frank, Mauclaire, Holban, Martin.)

7. Conception has followed homo-transplantation in animals. (Griegorieff, McCone, Amico-Roxar, Mauclaire, Magnus.)

8. Conception has followed hetero-transplantation in animals. (McCone, Mauclaire, Guthrie.)

9. Conception has followed homo-transplantation of the ovaries in women. (Morris, Frank.)

10. Conception has been reported following hetero-transplantation of the ovaries in women. (Morris.)

11. Hetero-transplantation of the ovaries should be accomplished as soon after the primary operation in which the receptor's ovaries have been sacrificed as possible, before the menopause has become established and the genitalia atrophied. (Martin.)

12. Transplanted ovaries in other localities than the normal will maintain their vitality, functionate, and prevent ordinary sequelæ of castration.

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AMERICAN GYNECOLOGICAL SOCIETY—THE PRESIDENT'S ADDRESS

PHILADELPHIA, MAY 26, 27, 28, 1908

BY J. M. BALDY, M. D.

FELLOWS OF THE AMERICAN GYNECOLOGICAL SOCIETY:

It is with profound regret that I have officially to announce to you the death during the past year of two of our Honorary Fellows, Dr. Robert Barnes, of London, England, and Dr. William T. Howard, of Baltimore, Maryland: the former one of the earliest guests of this Society after its organization; the latter a founder member and an ever active participant in your meetings. In the death of William T. Howard, we have lost one of the landmarks of our Society, one of the links of the past — a loss with which we are all equally grieved.

In this connection, it were well to remind you that in the process of evolution we are rapidly having our ranks depleted by the death of our oldest and most tried members. But few of our founder members remain with us, and these few are rapidly advancing in years. No organization can long stand such a drain and remain pre-eminent in its chosen field without replenishing its ranks with the best of the younger generation. It would seem that a systematic policy might with advantage be adopted by you, one which will keep your ranks from being completely filled so as always to have a place for *the* man when he appears, one which will studiously consider primarily an applicant's scientific attainments and fully establish these before allowing his qualities of good fellowship to warp your judgment. And as a secondary matter, might it not be well to avoid a too great concentration of strength in any one locality? It would appear that your membership on the Atlantic seaboard is too largely predominant and that other sections of this great country should be more fully represented.

In presenting this, your Presidential address, it would seem proper to discuss with you general policies, advances, and failures of the past and the duties of the future rather than to devote the time to a scientific paper. The objects of societies in general of this Society in particular are of a mixed character, scientific and social. The social side brings men together, gives opportunity for personal contact and estimate of personal worth, and no better way exists of discovering an individual's professional capacity than to become acquainted with his methods of thought, accuracy of observation, and process of reasoning as applied to those everyday affairs with which everyone, scientist or layman, is equally well acquainted and of which he is equally competent to judge. In this way, in a large measure, are we able to form a fairly correct idea of one's professional ability, especially where the knowledge thus acquired is added to the analysis of his scientific papers and discussions. In this way are we measurably able to estimate the worth of his writings and his professional opinion. A man's enthusiasm, his seriousness, his belief in himself, and his logical defence of his position, although perhaps differing from one's own, cannot fail to impress the observer as to his ability and his honesty. The true worth of a man is rarely under-estimated by his immediate associates and peers; here he soon finds his proper level. The social side of an association's meetings has, therefore, more of value than at a superficial glance would appear, and it would seem that rather than to depart one iota from the high standard of the past as set by our Society we should view with pride the efforts expended in this direction and should continue in the future to develop this side of our meetings even more, if that were possible, than in the past.

The scientific side of our meetings has, from the organization of the Society, been of a very high standard and the transactions of this body contain about all that is known or worth knowing in the gynecologic and obstetric arts. It has been from time to time the effort of various organizations similar to our own so to conduct their meetings as to bring out the best results both as to papers and discussions. With this thought in mind, in 1904 your President, Dr. Reynolds, in his Presidential address suggested the establishment of fixed discussions with a series of papers limited as to time, followed by discussions of a similar character. In consequence of this suggestion, you have had a programme which has occupied the mornings of the first two days with a symposium of subjects previously selected by your council. This depature from the past has had its advantage, but has also had its disadvantages. It has a tendency to develop short abstract papers as against fuller and more scientific ones. It occupies the two most important sessions of your meetings. In the second day it interferes with your Presidential address (which is fixed at a stated time) and your President's address interferes most materially with the symposium. No paper or series of papers receives the same thoughtful and thorough consideration in a discussion which is interrupted by a subject foreign to its import as does one which is continuous. The symposium feature is a valuable one and should be continued, but were it not well at this time to recast the lines and modify it to the extent of one symposium day or, if two be still considered desirable, to confine the days to the first and last of the meeting. If this were done a session which is generally a broken one and one of more or less failure, on account of the departure of members for home on the last day, might be rendered equally as important as the others, and would have the additional advantage of leaving your second day open exclusively to well-developed scientific papers and with no interference with your Presidential address. These thoughts are offered for your consideration and mature judgment and for the action of your council.

In looking over the field of our endeavors for the past year, I find nothing new advanced nor any startling improvements on the old. After a decade of obstetric and gynecologic activity unprecedented in any branch of medicine, we seem like wise men to be resting, retrospecting, and putting our house in perfect order before proceeding farther. Notwithstanding this, the signs for the future are bright, and when we note on the one hand the activity of the obsetric world in that great undertaking, the prevention of blindness at the beginning of life, and the activity of the gynecologic world

in the fight against that greatest of all scourges of middle life, cancer, we may look with complacency upon the criticism which has predicted the end of our branch of medicine as a specialty. In fact, after having developed the basic principles of everything known in abdominal surgery and having made it possible by our pioneer work for the general surgeon to develop what little good he is responsible for in visceral surgery, we may even yet develop a field common to us both, the vast importance of which has been only too long neglected by all, anæsthesia.

The general administration of anæsthetics as performed to-day is the shame of modern surgery, is a disgrace to a learned profession, and if the full, unvarnished truth concerning it were known to the laity at large, it would be but a short while before it were interfered with by legislative means — and properly so. In the traditions of our profession the poor receive as good service as the rich, so in the matter of anæsthetics is this true only with this difference: in the first instance, they both receive the best that is in us, in the latter they both receive the worst. Who of you is not familiar with the patient coming for a possible operation whose one dread is the approaching anæsthetic, a dread born of a past personal experience or the experience of a friend? Who of you is not familiar with the terrible struggle for breath so common to the etherizing room of the past, the congested blackened face, the prolonged anæsthesia, the patient only partly relaxed, the delay in the operation, the difficulties of the manipulation after an operation begun, the heartsickness at a difficult and delicate operation made doubly and trebly so from the unnecessary chances of sepsis, hæmorrhage, and shock, the feeling of a patient lost from no lack of skill of your own, the slipping of a ligature and a secondary operation or death, the immediate death on the table from failure of the heart, drowning due to inspired sputum, the vomiting on the operating table to the detriment of the operation, the prolonged after period of nausea and vomiting to the great suffering and misery of the patient, the inspiration pneumonias and other pulmonary complications, the nephritis and urinary suppressions — all due in great part to faulty anæsthesia? How many deaths at the time of the operation, shortly after operation, or some days or weeks later are due to the same cause? What relation does the anæsthetic bear to the large group of pulmonary complications reported from so many different sources, and what is its relation to the thromboses and embolisms which have in the past caused so much suffering and disaster? What of the fatty degenerations of the liver, heart, and kidneys? Who can tell? This fact is certain, however, more deaths following operations are due directly and indirectly to the administration of the anæsthetic than the profession in the past has dreamed of. Wherein lies the fault and where is the remedy? The present long established and time honored custom of having the anæsthetic administered in hospitals by the resident physicians, in private homes by any available doctor in the neighborhood is to be condemned. The man who is able and ready to pay any amount of money for the services of the most skillful surgeon available has his life and those of his family unknowingly put at the mercy of a boy just from his books with absolutely no practical knowledge of anæsthetics and with less teaching. One has only to recall his own experience and feelings during the first few weeks of his apprenticeship at anæsthesia to realize how thoroughly at the mercy of chance was the survival of the patient and how utterly helpless he would have been had anything gone wrong. Is it an exaggeration, then, to call such a condition a disgrace to the profession of medicine?

Who is to blame for this state of affairs? The young men to whom the anæsthetic is relegated? By no means. As a rule, they are a hard-working, well-meaning, and enthusiastic body of men eager for knowledge and faithful to every trust. The anæsthetic is placed in their hands, and they do the best they know how and are in no way to be blamed if, although ignorant and inexperienced, they are placed in a position of trust in the operating room second in importance only to that of the surgeon. Are hospital managers at fault? It would seem not. They accept the customs of the past as they find them, and if the medical men on whom they depend for instruction in medical matters are so derelict in their observation, knowledge, and duty as to remain content, who

can find fault with the hospital management? Who, then, is at fault in this most grave matter? We ourselves, gentlemen, and we alone, members of the medical profession. We have remained too long bound by the traditions of the dark ages of surgery; we have so devoted our attention to the discovery of new operations and to the development of their technique, that we have too long forgotten one of the most vital points in our operating rooms. Unless we arise shortly to the importance of this reform ourselves, an awakened public opinion will take charge of the matter and legislate us into a safer position. Fortunately, the reform is in sight. Occasionally, we hear an isolated voice raised against the continuation of this state of affairs, a protest which is lost in the general activities of professional life; in a few bright spots we see an effort made to reform, with an isolated hospital here or there employing a salaried anæsthetizer. And herein lies the remedy — a salaried anæsthetizer in each and every hospital in the land, with a salary of sufficient size to attract to the service men of proper intelligence.

Dollars and cents will be an important item in the success of this movement and a sufficient sum to entice a young man of brains for any great number of years away from a full professional life with all its rewards will be found difficult to raise. Fortunately, however, woman offers a solution to the problem. The qualities of a woman are just those requisite to quiet and soothe a frightened or timid patient approaching the anæsthetic, and she is the better qualified to devote her whole attention to her work from the fact of her having no ambition to do surgery and, therefore, having less incentive to neglect her anæsthetic in order to watch the manipulation of the surgeon. In addition, is not her very timidity an advantage in that it makes her realize more fully her responsibilities and keeps her more attentive? And, finally, an amount of salary which will prove attractive and permanently remunerative to her would be no temptation to a physician who had the fuller field of professional remuneration ahead of him should he prove a success. Women have been tried in this capacity with the greatest success and the matter is beyond the experimental stage, Many brainy women fully capable of being trained to this responsible position have entered the nursing profession, and it is from this source we may look for a solution of our difficulties. Women are being tried and are proving most satisfactory as anæsthetists, and it will be a bright day of advance in the technique of the operating room when their services are more generally adopted. It is only those of us who have been so fortunate as to have at our service a skillful and competent anæsthetizer who can fully appreciate the difference in results, both as to the satisfaction of doing our work, the celerity and safety of its execution, and the comfort and safety of the patient both during and after the operation. It behooves the medical profession to arouse itself to the importance of this reform before the public fully realize the situation and take the matter into their own hands. And it is befitting us as a scientific and surgical body to once more take the lead and point the way to the surgical world to the one great reform remaining in the perfection of our technique.

It only remains for me to express to you my gratitude for the appreciation you have shown of my past interest in our common association by making me your President. It has been one of the ambitions of my professional life to hold this honor, the greatest in your power to bestow and one which will for all time be worthy the ambition of any man. And it will always be a matter of intense pride with me to remember the fact that you have deigned to associate me with the names of such distinguished men as have presided over your deliberations in the past, Fordyce Barker, Peaslee, Gaillard Thomas, Sims, Emmett, Kimball, Albert Smith, Goodell and many other immortals of a great and recent past.

CÆSARIAN SECTION VERSUS SECTIONS OF THE PELVIS IN DEALING WITH MECHANICAL OBSTRUCTIONS TO CHILDBIRTH[1]

By A. LAPTHORN SMITH, M. D.

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A FEW years ago the writer was opposed to Cæsarian section, but his objection was only relative and not absolute; for as long as the operation had a higher mortality than the condition it was intended to relieve he felt that it should be resorted to only in extreme cases. As soon as the technique had been so improved that there was almost no death rate to it, he became an ardent convert. And now we have found out that the high death rate which used to follow it was not due so much to the operation as to the delay in performing it. Any operation will have a high death rate when performed on infected and dying women. But if Cæsarean section is performed early enough, it is the safest of all abdominal sections. Indeed, it may be called a benign operation because it is free from the lacerations and bruises which are inevitable in the *accouchement forcé*, especially when the Bossi dilators are employed. These have a high death rate from hæmorrhage and infection. With the modern Cæsarian section, there is neither of these causes of death. And it is surprising how quickly it can be done by an expert, one or two strokes of the knife and we are down to the uterus; an incision in the latter an inch long enables one to put the two forefingers into it, and to tear the incision up and down to about six inches. The feet are caught and the whole ovum placenta and all is quickly drawn out and handed to an assistant who opens the membrane and ties the cord. All this takes very little over a minute. With a good assistant to hold the two broad ligaments there is very little bleeding, certainly not more but rather less than is lost at an average normal labor. For convenience in sewing, the uterus can be lifted out and placed on a sterilized towel; the longest part of the operation being the sewing of the rent in the uterus with interrupted sutures. Although I employed this method in my three cases, I believe that a running catgut suture only taking in the muscle would hold the latter together while another running suture of fine chromicized catgut would take care of the peritoneum. The mucous membrane requires no suturing. By this change in method of suturing the uterus, the total time from first incision to placing last stitch could be easily reduced to less than thirty minutes; my cases took about forty. The most remarkable thing about the Cæsarean section is the well-being of the woman afterwards as compared with a forceps delivery. My two cases who recovered had absolutely no rise of temperature, which they almost surely would have had if the child had been dragged through the vulva. I have long felt that the terms milk leg and milk fever should be abolished and called by their true name, puerperal infection or septic absorption through the more or less severe lacerations of normal labor or the very severe ones of a forceps delivery. The woman who is delivered by Cæsarean section before labor begins is not only saved all pain but is saved all this danger. My third case was a primipara; she felt so well the day after the operation that she assured me again and again that it was a shame to keep her in bed. With regard to the child, I believe that it was more than a coincidence that it seemed to have neither pain nor ache enough to make it cry. The forceps have been and always will be an immense boon to women with moderate degrees of mechanical obstruction but there is another and quite large class of cases where the forceps inflict upon the child severe injuries — injuries the full extent of which is not yet recoginzed, being much more important than even the death of the infant.

I therefore think that the time is not far distant when women who so nearly die at every confinement that their family physician orders

[1] Read before the American Gynecological Society, Philadelphia, May 26, 1908.

them to separate from their husband (and thus break up their home) may have such a safe and painless delivery by Cæsarean section that they will cease to have the awful horror of becoming pregnant, which is becoming so wide spread on this continent.

In a paper read ten years ago before the Southern Gynecological Association, I pointed out that muscles which are not used atrophy, and that even the bones to which these muscles are attached grow smaller; in other words, that the over-educated, under-exercised woman who thinks and plans what others are to do but does nothing herself, has a much more difficult task to drive the child through the smaller pelvis with less muscular power to do the driving than her working sister. I also pointed out that such women marry rich brain schemers, and if there is anything in heredity at all, these children will have larger heads than normal. If the child's head continues to increase in size and the mother's pelvis to grow smaller and her muscular power weaker, a normal labor will become, and indeed in many cases it has already become, almost impossible. No substitute for normal labor can compare with Cæsarean section. The pubic operations all have the defect of causing an incised wound in a place where it is difficult to keep it aseptic, while they do not do away with the bruising which usually accompanies a forceps delivery. After one has taken the risk of hæmorrhage in a place where it is difficult to control, one still has the risk of bruising and tearing and infecting the soft parts; the cutting of the pubic bone or cartilage does nothing to make the passage through the soft parts less difficult. So that in all methods of artificial delivery at full term other than Cæsarean section, we have to reckon on injuries to the soft parts, that is, the cervix, vagina, and perineum, and sometimes the bladder and ureter. These injuries are known and recognized to some extent to be the cause of puerperal deaths but their full extent has not yet been admitted. Many a woman has had her uterus washed out and curetted until she died, while the real cause was septic infection of tears of the vagina and perineum. Over and over again the writer has been called in consultation to women who have been in furious labor for twenty-four hours and yet the head was not engaged. But the woman was exhausted and the situation intolerable to the patient, the family physician, and the friends. Something had to be done and we did the best we knew in those days, namely, put on the forceps and dragged the head through. Often it required three people to hold the woman on the bed and two to pull on the instruments. The child was delivered but generally dead; in some cases it lived but with permanent injury to the brain. Sometimes we had to perforate the head of the living healthy child, in plain English, kill it for no fault of its own but just because its mother's pelvis was too small. Whole chapters were written in standard books on Obstetrics describing how to kill the child and cut it up, and every well-furnished obstetric bag was provided with proper cranioclasts and perforators. But to-day such treatment would be unjustifiable in a city or near a city where an expert can readily be found able and willing to do a Cæsarian section and save both mother and child. Fortunately, these cases occur rarely in the country where the women work and walk and marry men with normal brains. Up to within the last year or two, it has seemed less shocking to kill the child and almost kill the mother so long as delivery took place per vias naturales than to do a benign and gentle operation where skill and speed have taken the place of brute force. But the time has come, the writer thinks, when the family physician should shrink from killing the helpless child as well as from making the mother run an unnecessary risk of her life and health.

It will depend upon him, much more than upon the operator, whether Cæsarian section shall have absolutely no death rate or not, for both of the lives concerned, according to whether they have both been seriously injured or not by forceful but futile attempts at instrumental delivery.

IMMEDIATE VS. DELAYED (EXPECTANT) OPERATION IN CASE OF ECTOPIC GESTATION[1]

By EGBERT H. GRANDIN, M. D., New York
Consulting Gynecologist to the French Hospital, Attending Gynecologist to the Columbus Hospital, Associate Surgeon to the Woman's Hospital in the State of New York

IN order to justify my position, allow me to state in brief the experience upon which it is based. My initial experience with ectopic gestation was when I saw the late Paul F. Mundé treat a number of subjects by means of electricity. This was the method then in vogue in this country. I recall well one of the instances when the late T. Gaillard Thomas was the consultant. The subject went into deep shock and required my attendance at her bedside for over thirty-six hours. She recovered, as indeed did all the others I saw subjected to this treatment. I question now if it can be maintained with a show of exactitude if many of these cases were instances of ectopic. In all justice to the observers of those days, let me remind you that abdominal section was then a rarity for any condition.

Imbued with this teaching, I proceeded to treat instances which offered to me after this electrical fashion. In 1892, I saw a case of ectopic with the late Dr. Little, of Astoria, administered electricity and the woman promptly collapsed. She recovered. Such experience set me thinking, and after fighting the subject out, particularly with our honored associate, Dr. Janvrin, I saw a great light and from that day to this there has been but one treatment for this condition at my hands, and this has been the surgical just as soon as the evidence of its existence was fairly presumptive.

It so happened that the very first opportunity I had to show my change of heart, was on the woman referred to above as having been electrified for Dr. Little. I sent the woman to the French Hospital and there performed the first deliberate abdominal section for ectopic ever made in that institution. I found an unruptured ectopic on the left, and a diseased tube on the right, the side I had presumptively cured of ectopic by means of electricity about two and one-half years previously. Since this time, I have operated upon or been chief consultant at operations upon over one hundred instances, not including hæmatocele formation. Placing the number seen at one hundred, in order to secure definite percentage, the only instances which have died—two in number—were where expectancy ruled. I have no record of the number of hæmatoceles I have seen, but I recollect distinctly two deaths, the women reaching me *in extremis*, although the history pointed unerringly to the fact that abdominal section had offered distinct indication at least ten days previously.

Now, such being my personal experience, I shall maintain that prompt surgery should convert this malignant disease into one carrying the certitude of recovery, other things, of course, equal. I shall also maintain, that the ideal surgery is to operate before rupture. To go further, I shall maintain that operation should be resorted to on presumptive evidence, it being my preference to be proved wrong in diagnosis rather than to sit on the fence awaiting the diagnosis made at the time of rupture. In three instances, I have applied this rule, and whilst I did not find ectopic, I did find diseased tube and ovary. I shall further maintain that the only logical, safe, and surgical method of treating these cases is through the abdomen, the vaginal route being reserved for diagnosis and for hæmatocele formation.

In the latter event, hæmatocele, I shall maintain that, in the absence of suppuration, and in the presence of requisite vitality on the part of the subject, the proper course is to open the abdomen and to exsect the damaged broad ligament. I have done this in a semi-tenement house with recovery.

Let me state that the instances I have seen and which form the basis of the above expressed views, have been of all types, ranging from unruptured instances to those where the abdomen was full of blood even up to the ensiform cartilage. And let me further state

[1] Read before the American Gynecological Society, May, 1908.

that, if this discussion is to benefit us at all, and through us educate the general practitioner, it must be by the individual speaker and writer approaching it in the spirit which I am exhibiting, that of having firm convictions based upon ample experience.

From contact with other operators and as the result of reading the views expressed in writing by still others, I believe that the points I have stated will find acceptance, the difference of opinion alone arising as to the choice of route — whether abdominal or vaginal. For the purpose of this discussion, I take it that it is intended to limit the essayists strictly to the question as to whether immediate or delayed operation should be the choice where active hæmorrhage is in progress or where the subject is in collapse as the result of profuse hæmorrhage.

Those who favor delay under such conditions argue somewhat as follows:

1. It is contended that the subject rarely dies as the result of the first hæmorrhage. This is freely granted, but what means have we of determining that the hæmorrhage has ceased? and how do we know that a second hæmorrhage is not imminent? Often, and this I have proven in the operating room, the first hæmorrhage is into the sac or perhaps consists of extrusion of a slight amount of blood into the cavity. This is often sufficient to cause collapse, not so much because of the amount of blood lost, as from the peritoneal irritation. Now, if we can reach the source of hæmorrhage at this stage of the game, before peritonitis and adhesions have set in, will any one gainsay that this is to the great advantage of the subject? Clinically, primary rupture, or primary abortion, is only a prelude to secondary hæmorrhage. Applying the expectant treatment to instances of primary rupture, with the therapeutic measures which are naturally resorted to, we of necessity raise blood pressure and thus assist in causing secondary rupture. Therefore, from my point of view, operation should be performed as soon as feasible after symptom of rupture, where we are unable to reach diagnosis before rupture.

2. It is contended that analogically subjects of hæmorrhage from the stomach, or as the result of typhoid perforation or from uterine fibroids, rarely die at once. This is granted, but the analogy is a weak one since the surgeons with whose work I am familiar, in case of typhoid perforation, for instance, are going to operate at once and not await a second perforation. Similarly, we should act in case of gastric hæmorrhage; and as for fibroids of a hæmorrhagic type, every one is agreed that the earlier the operation, the less the mortality rate, since the interstitial changes in the heart and kidneys are thus avoided. Repeated hæmorrhages into the peritoneal cavity only render the operation more difficult and more prolonged, so that, other things equal, the longer we wait the lower should be the recovery rate.

3. It is contended that expectancy enables us to secure better surroundings, more instruments, more competent assistants. This is the argument of the pure hospital surgeon. I cannot gainsay the comfort derived from having all these attainments, but those present who have operated in tenements for this condition will agree with me that, however much such attainments may be desirable, they are not necessary. I am not afraid of surroundings, provided I can sterilize the field of operation. Few instruments are requisite, trained assistant is not necessary. The surgeon having confidence in himself and his knowledge need only get into the abdomen, tie off the damaged tube, and get out of the abdomen. "Tinkering" and "fussing" and "mussing" in the cavity simply render the prognosis very gloomy. The peritoneal cavity will take care of blood clots better than it will stand repeated insult from over-zealous and unnecessary manipulation. After the bleeding point has been tied off, so to speak, then is the time for stimulation. I have thus operated from choice with the pulse over 160 and I have never regretted it as much as I have wept, metaphorically speaking, over the subjects brought to me after expectancy has ruled.

I am not denying the statements that many women have tubal abortion or slight rupture and recover without operation. I believe that many women abort from the tube with such transient symptoms as scarcely to attract attention. I am basing my argument purely on the feeling that the woman is far safer just as soon

as she is placed beyond the risk of another hæmorrhage, and I do not believe that a rapid incision, removal of the product of conception and its sac, carries so much risk or adds so much extra shock as temporizing in the absolute ignorance as to whether bleeding has ceased or not or may not at any time recur. My desire is that we should, like skillful generals, strike the first blow at the enemy, in this case, *Death*, and my own personal results and observation and thought teach me the value of decision and action as opposed to wavering and expectancy. In any other part of the body, in the face of hæmorrhage, we do not wait for clotting and rallying, trusting to the element of luck that the hæmorrhage may not recur. The same rule, and for weightier reasons, should be applied to the peritoneal cavity.

A REPORT OF FIFTY-TWO PREGNANCIES AND LABORS FOLLOWING VENTRO-SUSPENSION OF THE UTERUS FOR RETRO-DISPLACEMENTS[1]

By JOHN OSBORN POLAK, M. Sc., M. D., Brooklyn, New York

THE complications in pregnancy and labor which may follow the operation of ventrofixation of the uterus for retro-displacements in the child-bearing woman, have been tabulated by Kelly, as follows: Marked retraction of the scar, due to the tugging of the adherent uterus; constant hypogastric pain; retraction or displacement of the cervix, as the pregnancy advances, to a degree which may even carry it up into the abdominal cavity; the anterior portion of the uterine body may fail to expand and form a large, fleshy, tumorous mass obstructing the superior strait; the posterior wall may become excessively thinned and rupture; abortion and premature labor may come on spontaneously; persistent and excessive nausea may result from traction on the scar; the labor may be delayed some weeks beyond term, and when it occurs may be powerless, owing to the inability of the thinned-out posterior uterine segment to expel the fœtus; the labor may be obstructed by the mass of tissue in the anterior wall, as by a tumor; the proper expansion of the cervix may be hindered by its high and abnormal position; malpresentations of the fœtus may occur, or, finally, the uterus may tear loose from its moorings with the formation of a large hæmatoma at the point of rupture.

Do the foregoing complications also hold true in ventro-suspension of the uterus, and is the general condemnation of the operation justified in the light of our actual knowledge of the results? These are the propositions which my personal experience with pregnancy and labor following suspensio uteri answers in the negative. I hope in this brief communication to convince some of my hearers that this simple procedure may be done with comparative safety in the course of intraabdominal operations without the production of harm to the woman in her subsequent gestations.

In a study of the literature as to the effect of suspension of the uterus on subsequent pregnancy, I find that little or no statistical distinction has been made by the various reporters between the operations of fixation and suspension; for, upon analyzing Lynch's report (1904), one is impressed with the fact that in only 2 of the 21 cases of Cæsarean section reported was a suspension operation done. Eighteen were deliberate fixations and the nineteenth leaves doubt as to the character of the original operation. Again in Noble's exhaustive review of the subject, presented to the American Gynecological Society in 1896, no distinction was made as to the method of operating. Andrews, in 1905, collated 395 cases of pregnancy following fixation or suspension of the uterus, with 359 patients going

[1] Surgical Thesis before the American Gynecological Society, 1908.

to term; but here again no distinction has been made between the operations. The cases reported by Hurdon and Williams in 1906, where Cæsarean section was done to relieve the dystocia, were in women on whom fixation and not suspension had been performed. Humpstone also reports three cases of Cæsarean operations not previously noted in the literature, two occurring in my service at the Methodist Episcopal Hospital and one in the service of my colleague, Dr. Pomeroy, all of whom had had a ventrofixation done by general surgeons. The operations were made by passing two or three deep silkworm gut sutures, so as to include the posterior fundal wall of the uterus and all of the layers of the abdominal parietes, yet one of these cases is classed as a suspension, and charged up among the unfortunate sequelæ credited to that operation. One of Peterson's two cases of suspension, which necessitated abdominal section to accomplish delivery, is the only record in which a suspensory ligament has been noted as producing such untoward symptoms. The suspension in his case of lumbosacral kyphosis with funnel pelvis resulted in a fixation and a thinning out of the posterior uterine wall during labor, as is the rule when the fundus is fixed. This must be admitted as one of the possible results of suspension. It is hardly sufficient, however, to condemn the operation, because there was present in this instance a complication, in itself sufficient to thin a uterus. Before condemning suspension, moreover, an unprejudiced observer stops to consider the thousands of suspensions done every year by various operators and the small number of complications reported.

My defence of the operation is based upon a personal experience of 687 suspensions done in the course of operations for almost all forms of tuboovarian and appendicular disease associated with retrodeviation of the uterus.

The technique of Kelly has been somewhat modified in my clinic, by the substitution of No. 1 ten-day chromic gut for the silk suspension suture, and I do not go quite so low on the posterior wall of the uterus in my transfixion of that organ.

The uterus falls into good anteflexion and the patient is placed in bed in the elevated trunk posture, which directs the intraabdominal pressure against the posterior fundal wall. Special care is taken not to scarify or irritate the point of attachment. The bladder is emptied frequently with the catheter until the patient is able to void her own urine, and the tension of a heavy uterus on its delicate suspensory adhesion is minimized by the introduction of a properly fitting Byrne retroversion pessary, when pelvic plastics have not been done at the same sitting. All of these patients are made to wear a pessary for some months following the operation or until such time as the size of the uterus has become reduced. This little point of detail is, I believe, the explanation of my freedom from recurrence — only 8 relapses are to be found among the 301 private patients included in this report.

In 416 women one, or a part of one, or both ovaries were retained and a patulous tube or tubes preserved. Out of this number, 52 pregnancies have been recorded as following the operation. Of the total 687 cases, constituting the statistical basis of this contribution, 301 were private patients, of whom careful records for periods of from one to eight years have been kept. In no instance was the abdomen opened for the correction of a simple uncomplicated retroversion which could be replaced with the patient in the knee-chest position and maintained by a pessary. One hundred and seventy-eight of this group of private patients were able to conceive, any resulting sterility not being due to the impatency of the tube or tubes or to the ablation of the ovaries. Thirty-four pregnancies followed, all of which were attended in labor by the writer. Two women miscarried at the fourth month. One of these patients had had a high amputation of the cervix some months before and had been kept in bed at the menstrual epoch throughout her gestation, owing to the occurrence of pain and dilation at each period. An abortion was deliberately induced in the other woman for a hyperemesis due to the toxæmia of pregnancy. She had suffered from a similar toxæmia and induction was called for in her previous gestation. Neither of these abortions can be attributed to the operation of suspension, as in both instances the uterus developed normally, was freely movable, and

there was no dragging on the abdominal scar or hypogastric pain.

But one malpresentation occurred. This was a breech which terminated in spontaneous delivery at the eighth month of pregnancy. The cervix in this patient was drawn up and on a higher plane than normal during the early stage of labor.

Forceps were used but twice, the indication in both patients being a slow second stage, with an imperfectly rotated head on the pelvic floor. As the position of the fœtus, in both of these cases, was a posterior one at the beginning of labor and both women were primiparæ, we do not feel that the dystocia, necessitating forceps, was due in any way to the suspension.

In 31 cases the head presented in one of the vertex positions, in contrast to the usual statement by most observers that malpositions are more frequent in labors following suspensions of the uterus. Twenty-nine of these women delivered themselves of children — varying in weight from five pounds, one ounce, to eight pounds, four ounces—without difficulty or intervention. The character of the labors differed in no way from the normal. The contractions of the uterus were not influenced either in power or regularity by the operation.

Labor occurred in 12 of these patients two or three weeks before the computed termination of their gestation. None was delayed more than a week beyond term. There was no fœtal mortality or maternal morbidity, except in one patient, where a small broad ligament exudate existed, and there followed a mild putrid infection of the uterus, from the retention of a small piece of membranes.

One point has impressed me in all of these labors, which is at variance with the reports of other observers, namely, that the presenting part descended into and became engaged in the pelvis early, often a week or two before labor occurred, even in the multiparæ included in this series, while the frequency of this occurrence must make us doubt that it was mere coincidence, nothing in the character of the pregnancy or labor in any of these women would point to the operation as a cause.

Of the 18 reported pregnancies and labors not attended by the writer, but included in the 52 cases cited, there were no abortions and no malpresentations. There was one premature labor at the eighth month with spontaneous delivery; and one dystocia from an occipito-posterior position, necessitating delivery with axis traction forceps, because of the arrest of the head in the middle pelvic plane. There was one stillbirth due to a short cord. There was no maternal morbidity which can be attributed to the operation. When one can report but three forceps deliveries in 50 labors, it would seem that suspension, if there was a suspension at all in any of these patients, has little or no effect on pregnancy and labor.

Each of these 416 women, in whom pregnancy was possible, was told at the time of her discharge following the operation to report to the writer for examination if she became pregnant, or if she failed to do this and was living in the city and should experience any difficulty at labor, to ask for consultation with him. Hence, I feel that the foregoing statistics are reliable and have a greater practical value, perhaps, than many recorded and collated by other observers.

Among the 301 patients of whom I have frequent examination records, but eight relapses occurred. Two of these followed confinement and could be reposited and held in position by a pessary.

In one woman the uterus relapsed into a position of retroflexion within a month after the operation, with a return of her pelvic symptoms. Fortunately the adhesions, freed at the time of the operation, left the uterus movable. It was reposited by bimanual manipulation and has been maintained with a pessary, which is worn with more or less comfort. The remaining 5 cases in which the operation failed to correct and retain the displacement have passed from under my observation.

I have had occasion to examine 47 of the 52 women who have become pregnant and were delivered subsequent to the suspension. In only 4 had the uterus relapsed into retroversion. Two of these, as has already been stated, could be and were replaced. Five women failed to respond to my request for permission to examine them. This is a larger proportion of uteri in position after labor than follows in the natural course of events, even in women who have had no operation for the correction of a displace-

ment, and tends to show the permanency of the operation, notwithstanding the stretching of the suspending ligaments consequent upon the strain of pregnancy and labor. These results are superior to those obtained by me from either the Alexander, the Mann, or the Gilliam operation. It will be contended that I have not given these procedures ample consideration or sufficient clinical test to express a definite opinion as to their relative merits. This is not so, however, as each of the operations mentioned has been tried out in thirty to forty patients and the results carefully noted.

The condition of the suspensory ligaments, when the abdomen has been reopened for other conditions, has been an interesting study. Fourteen of these women have been re-operated, 5 have had hysterectomies for fibroids, 4 have had a secondary operation for recurrent ovarian disease, 2 have undergone a subsequent procedure for a painful and inflamed appendix, 2 have suffered from a gonorrhœal infection of the tubes which necessitated their removal, and one was operated for an ectopic of the remaining tube. Each of these sections has given me an opportunity to note the condition, structure, position, and length of the suspensory ligament or ligaments maintaining the uterus in position. In none had fixation of the uterus occurred, notwithstanding that in three of the cases re-operated, an extensive inflammatory process was going on within the pelvis prior to the abdomen's being reopened.

The ligaments varied in length from three to six centimeters and were about one centimeter in breadth, allowing free mobility of the uterus. There were no omental or intestinal attachments in thirteen of these cases. One of my hysterectomies presented dense omental adhesions to the anterior face of the uterus and its suspending ligaments. This may be explained, however, by the fact that this patient had had a myomectomy and both tubes removed six years before, affording an extensive surface for adhesion.

It has been claimed that suspension of the uterus places the organ in an abnormal relation. This statement I feel is based on prejudice rather than upon observation; for the majority of these women have been examined many times since their retrodeviations were corrected and the uterus has been found movable and, apparently, as free in its excursions as if no attachment to the abdominal wall existed. Manipulation has failed to dislocate it backward, and only in a few cases have I observed tenderness at the site of the suspension. Few of my patients have experienced any bladder irritability following the operation; and even when pregnancy has occurred the vesical symptoms have not been greater than when associated with gestation in an anteflexed uterus.

Six patients in this entire series have died, four from septic peritonitis, one from cerebral embolism, and one from ileus. This last patient was autopsied nineteen days after her operation, which had been a dilation, curettage, appendectomy, and ventro-suspension. The uterus was found movable and lying in easy anteflexion, held by two short peritoneal bands, about 2 centimeters in length, at the site of the original suspension. A loop of the ileum was found buckled on itself and adherent to the omentum, a portion of which had been resected owing to the damage done to it while freeing its attachments in the pelvis.

"The fact that one never can say definitely that a woman will be free from serious dystocia, should she become pregnant after ventro-suspension, is enough to condemn the operation in the eyes of the conscientious surgeon," are the words of Peterson, in closing a recent paper on Cæsarean section following ventro-suspension of the uterus. My personal experience, as cited above, contradicts this statement and seems to justify me in continuing to perform the operation.

Every few months for the past fifteen or twenty years, a new operation, or some modification of an old one, has been suggested to the profession for the correction of retro-displacements, and, together with my brother surgeons, I have tested them out, each in its turn.

For nearly two years, Mann's operation of folding the round ligaments upon themselves and suturing them in this shortened position was used in our work. The large number of relapses, as well as a number of subligamentous hæmatomata from needle punctures, caused me to abandon it. Alexander's and its modifications, Dudley's, Baldy's as well as Goffe's, and

vaginal fixation, have had attention, until Gilliam's method of suspending the uterus was published. In this operation, we thought we had an ideal procedure, as it permitted not only the performance of the necessary intra-abdominal repair, needed by so many of these women, but allowed us to suspend the uterus by its natural ligaments. My records show that 33 of these operations were done, in which 6 primary suppurations occurred. Two patients became pregnant, and were delivered at term without complication. At the post-partum examination, a month after the confinement, their uteri were found low and retroplaced. The chief disadvantage of the operation is that it swings the uterus from the abdominal wall by its anterior face, and does not sufficiently anteflex it to secure and maintain the intra-abdominal pressure on its posterior surface. A second objection is the likelihood of suppuration in the wound.

My experience with pregnancy or labor, subsequent to this operation, and the complications which they may produce, is too limited to allow of any deductions.

From a critical study of the above statistics, it will be seen that ventro-suspension of the uterus has not influenced or complicated any of the pregnancies or labors in this series; and while it may be contended that this was but a fortunate coincidence in the light of the many reported cases of dystocia, yet it must be admitted that the number is sufficient to justify deductions. Furthermore, these results are in accord with those of Holden, of the Johns Hopkins Clinic, who reports 83 labors in 214 women able to conceive, upon whom a suspension had been done. Only 5 of these patients required forceps to effect the delivery. Abdominal pain during pregnancy was the only other complication recorded. This occurred in five patients, one of whom was among those requiring instrumental intervention, and also in accord with the report of Beyea, who records 42 uncomplicated labors following suspension.

I am convinced that a properly performed suspension leaves the uterus in as good position and is as free from the possibility of relapse as any of the several procedures advocated for a permanent cure.

The Webster method of shortening the round ligaments by passing them through the broad and under the uteroovarian ligaments, and fixing them to the posterior wall of the uterus deserves commendation, but my experience with it is limited, having used it but ten times, all in the past year. The results, therefore, are too recent to allow of any conclusions.

Many of us have been at fault in supposing that any form of suspension or shortening of the round ligaments can hold a heavy uterus with its fundus anterior without the aid of a pessary or a properly performed plastic repair of the pelvic floor to maintain the organ in its plane of circulatory equilibrium, until such time as post-operative involution has occurred. It is to the omission of this detail, that many of the relapses attributed to suspension are due.

After labor a certain degree of involution and shortening of the suspensory ligaments occurs. This fact has been noted many times while examining these patients subsequent to their confinement. Although it is possible to dislocate the fundus backward, for two or three weeks after labor, yet, when examining the same patient a month or two later, while the uterus retained perfect freedom in its excursions from side to side, the organ, when it was tipped backward by bimanual manipulation, would spring forward again into normal anteflexion when the pressure was released.

If these facts are as stated — and I believe them to be true — the simplicity and speed of the procedure must recommend it to the average surgeon, as it minimizes intraabdominal manipulation.

SUGGESTIONS IN TEACHING GYNECOLOGY, WITH DEMONSTRATION OF SPECIAL (MECHANICAL) CHARTS AS AN AID IN THIS WORK[1]

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FROM the standpoint of the development of the student's knowledge of medicine in general, three phases in the study of any of its clinical branches naturally suggest themselves:

1. The study of each disease as a "science" i. e., its etiology, the changes in anatomy occurring in its different stages as we see them in the pathological laboratory and, of the greatest importance, the study of the explanation of its symptomatology;

2. The rearrangement of the knowledge gained from the study of disease as a science in order that this knowledge may be applied to its greatest advantage in clinical work, i. e., the classification of the symptoms caused by the diseases studied, and the study of the various causes of each symptom from the standpoint of that symptom and also with a view to ascertaining how its causes may be differentiated. This phase may be called "the study of the significance of the various symptoms";

3. The study of the art or technique of the clinical branch of medicine under consideration which requires actual contact with the patient.

FIRST PHASE, THE STUDY OF ANY DISEASE AS A "SCIENCE"

In order that the student may clearly understand the changes caused by the disease in any part of the body, its effect on the individual as a whole, and the explanation of its symptomatology, knowledge of the following is necessary:

1. The normal anatomy of the organs and parts which may be altered by the disease, i. e., their development, structure, form, size, anatomical relations, mobility, *and the manifestations of these;*

2. The normal physiology of the organs and parts, how their functions are accomplished, and especially their sensibility because pain, one of the most important subjective symptoms, can arise only from sensitive structures;

3. The changes which the pathological process under consideration (whether injury, infection, or new growth) causes in the tissues of the body.

In addition, the student must realize that the symptoms of any abnormal condition are only manifestations of normal anatomy and normal physiology as altered by that condition; those which the patient perceives are known as subjective symptoms and those which the physician detects are known as objective symptoms. Thus equipped, the student is ready to study the diseases intelligently and, I believe, only when thus equipped.

The etiology and course of each disease may be demonstrated by means of sketches on the blackboard, charts, modelling clay, casts, or actual specimens, using whichever of these methods as are best adapted to the particular subject under consideration. In this way the various conditions arising during the course of any disease or resulting from it may be developed before the class, always beginning with the normal and from it developing the abnormal.

The conditions caused by each disease may thus be presented to the class as illustrated problems which they should attempt to solve from their knowledge of normal anatomy, normal physiology, the manifestations of these, and the knowledge of the changes caused by the pathological process present. In order to facilitate the solution of these problems, such questions as the following are asked (calling the members of the class up in turn): 1. Describe the abnormal condition present? How did it arise? 2. With what functions may it interfere? 3. What manifestations of altered anatomy and altered physiology may be noticed by the patient, i. e., what are the sub-

[1] Presented to the American Gynecological Society, May 26, 1908.

jective symptoms? 4. What manifestations of altered anatomy and altered physiology may be detected by the physician, i. e., what are the objective symptoms. 5. What conditions, already studied, may simulate the present one? As this phase of the subject is preparatory to future clinical work, methods of diagnosis, treatment. and prophylaxis may be briefly discussed.

The students are thus taught to observe, use what knowledge they already have and work out, with the aid of the teacher, the various problems presented, instead of memorizing data obtained from didactic lectures or text-books. The students' answers corrected, when necessary, and supplemented by information which they cannot be expected to reason out should constitute our present knowledge of the disease under discussion.

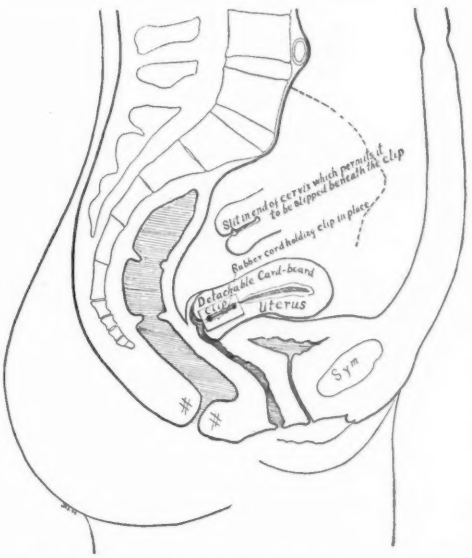
Slit in end of cervix which permits it to be slipped beneath the clip
Rubber cord holding clip in place
Detachable Card-board Uterus
Sym

Fig. 1. Illustration of (mechanical) chart representing the pelvis in sagittal section. The cardboard uterus may be removed and other pieces of cardboard, representing various pathological conditions, may be substituted.

The chart, from which the illustration was made, represents a natural size sagittal section of the female pelvis; the cardboard uterus is held in place by the clip shown in the drawing. The uterus may be moved about indicating the effect of distension of the bladder, posture of the individual etc., and as soon as the uterus is released the elasticity of the rubber cord, holding the clip in place, causes the uterus to return to its previous position. The slit in the end of the cervix (see illustration) permits the cardboard uterus to be removed and other pieces of cardboard, representing abnormal conditions, to be inserted as shown in the next illustration, thus showing that the normal may be replaced by the abnormal.

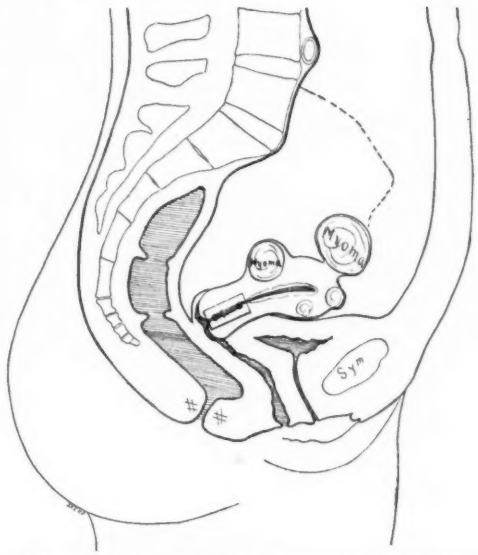

Fig. 2. Illustration of chart representing a uterus containing several small myomata.

The piece of cardboard representing the normal uterus shown in Fig. 1 has been replaced by one representing a uterus with several small myomata. This uterus may be moved about as in the previous instance.

This illustrated problem is presented to the class and they are expected to solve it from their knowledge of normal anatomy, normal physiology, the manifestations of these, and the knowledge of the changes caused in the pelvic structures by the condition present. They are aided in this work by asking such questions as these: 1. Describe the abnormal conditions present. How did they arise? 2. Do they interfere with the function of any of the pelvic structures or with the general well-being of the patient? and if so, how? 5. What manifestations of altered anatomy and altered physiology may be noticed by the patient? i. e., what are the subjective symptoms? 4. What manifestations of altered anatomy and altered physiology may be detected by the physician? i. e., what are the objective symptoms? 5. What conditions, already studied, may simulate the present one? 6. How can a diagnosis be made? 7. What should be the treatment of this condition? 8. Can this condition be prevented? and if so, how?

Let us consider the subject of uterine myomata from the standpoint of its study as a "science" and particularly with a view to the demonstration of mechanical charts as an aid in illustrating the various problems occurring in its different phases.

The development of myomata should be discussed first. Their possible situations in

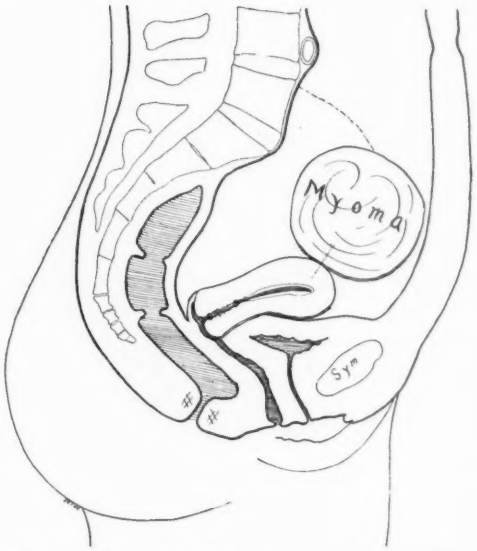

Fig. 3. Illustration of chart representing a medium size subserous myoma arising from the upper surface of the body of the uterus.

This condition could be represented as in the previous illustration, but is better shown by adding the myoma to the uterus. As myomata may arise in any portion of the uterus so "artificial myomata" may be added to any portion of an artificial uterus and the resulting conditions indicated and studied. The uterus is made of heavy cardboard and is held in place by a rubber cord passing through two holes in the cervix, which permits it to be moved about as in the previous chart. The myoma is also made of similar cardboard and can be attached to any portion of the uterus by means of the pin embedded in it.

The problem is presented and solved by asking questions similar to those asked in the solution of the preceding problem.

the uterus can be well indicated by drawings on a blackboard or by charts. The various degenerative changes are best shown by actual specimens. The frequency and significance of these changes should be emphasized.

The use of mechanical charts as a means of illustrating the problems arising in the various phases of this subject are shown in Figs. 1, 2, 3, 4, 5, 6, 7, and 8.

In this way and by means of other methods of illustration, the various conditions, arising from or associated with uterine myomata, may be presented to a class as illustrated problems and solved by them.

At the close of the study of uterine myomata, a clinical summary should be given. Their frequency, the age at which they occur, etc., should be discussed. The classification, which is usually presented at the onset of the study of any subject, I believe should be given at the close, as it is but an enumeration of the various types which have been studied. The one worked out in my course this year was as follows: 1. Small interstitial and subserous myomata — seldom any symptoms (Fig. 2); 2. Medium size subserous myomata — may or may not cause any symptoms depending on their situation (Figs. 3, 4, and 5); 3. Large subserous myomata — do not necessarily cause any subjective symptoms; 4. Small submucous myomata — may cause bleeding (Fig. 7); 5. Large interstitial and submucous myomata — often cause bleeding; 8. Submucous myomata protruding from the cervix; 7. Cervical myomata; 8. Adeno-myomata; 9. Myomata with secondary changes (degenerations); 10. Myomata with other pelvic conditions, as pregnancy, weakened pelvic floor, tubal infection, ovarian cysts, other uterine tumors.

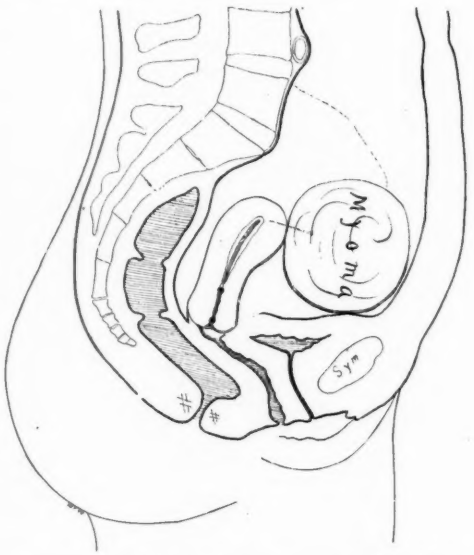

Fig. 4. Illustration of the chart represented in the preceding illustration, and demonstrating the effect of changing the position of the myoma from the upper to the anterior surface of the body of the uterus.

The condition resulting is presented to the class as an illustrated problem and solved as in the previous instance. See Fig. 2.

Fig. 5. Illustration of the same chart shown in Figs. 3 and 4, with the position of the myoma changed to the posterior surface of the uterus.

The change in the position of the uterus is well shown and the change in the rectum and bladder can be imagined or shown by another chart.

The condition resulting is studied as in the previous illustrations.

In this way the conditions resulting from *different size* subserous myomata in *various situations* may be demonstrated, and these same conditions may be studied as illustrated problems by answering questions similar to those asked in Fig. 2.

This chart may be used in the study of other conditions than uterine myomata by attaching pieces of cardboard, representing these conditions, to the uterus.

The student realizes that the symptoms of uterine myomata vary with their size, situation, whether or not submucous, with secondary changes and with associated conditions. He also realizes that often they do not cause any subjective symptoms, but may give rise to certain subjective and objective symptoms and, therefore, they should be considered when any of these symptoms are present in a given case.

Other abnormal conditions of the pelvic structures may be studied in like manner, some lending themselves to this method of presentation better than others.

SECOND PHASE, THE STUDY OF THE SIGNIFICANCE OF EACH SYMPTOM

Each symptom (whether subjective or objective), which may be caused by diseased conditions of the pelvic structures, is presented to the class for their consideration and is studied by asking the members of the class in turn such questions as will give for their answers the various causes of that symptom, how each cause gives rise to it and how these causes may be differentiated.

Let us consider the most important subjective as well as objective symptom referable to the pelvic organs, namely, uterine bleeding, as

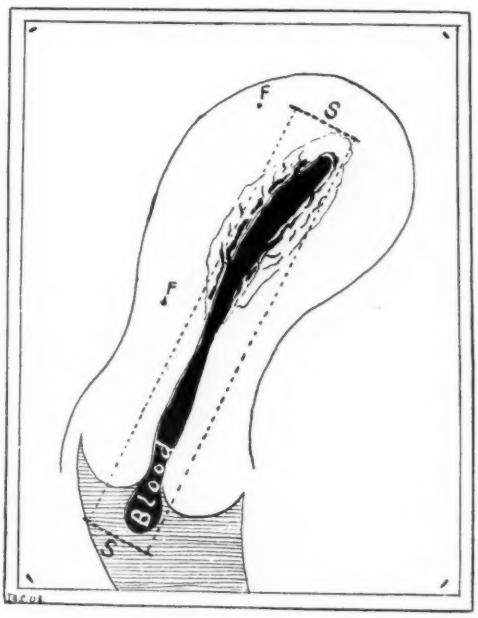

Fig. 6. Illustration of chart representing normal menstruation.

The chart represents the uterus (in sagittal section), about six times enlarged. The drawing is made on heavy index bristol board which is attached at its four corners to a very heavy pulp board. The endometrium is thickened and hæmorrhage into its tissues and just beneath the surface epithelium is indicated by red ink (black in the illustration). A strip of cloth about four inches wide (see dotted lines) passes through two slits in the pulp board (S S in drawing) which are so situated that the cloth lies behind the uterine cavity and portion of the vagina. The uterine cavity and portion of the vagina are cut and thus the portion of the cloth behind the part cut out is exposed. Half of the cloth is red (black in the illustration), and by drawing the cloth through the slits in one direction the red portion appears, i. e., bleeding, and by reversing the motion it disappears, i. e., the bleeding ceases. The two paper fasteners F F are for the purpose of attaching pieces of cardboard representing abnormal conditions, as shown in the next illustration and in Fig. 9.

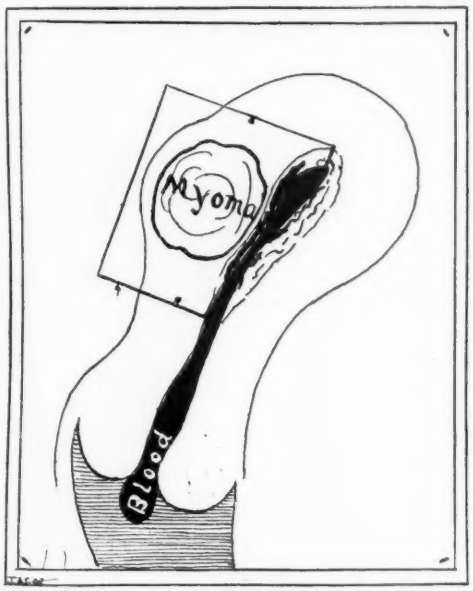

Fig. 7. Illustration of chart demonstrating the influence of a submucous myoma on menstruation.

A piece of cardboard representing a submucous myoma has been attached to the chart shown in the previous illustration by means of fasteners F F. The thinning of the endometrium over the tumor is shown and the local congestion often resulting from the same is indicated by the increased hæmorrhage into the tissues of the endometrium at this place.

Menstruation is indicated by drawing the cloth so that the part stained red (black in illustration) appears and this with the increased local congestion of the endometrium over the myoma suggests that a submucous myoma is apt to prolong the menstrual flow and make it more profuse.

an example of a symptom which is very well adapted to this method of teaching. The members of the class are asked to enumerate the various conditions (already studied) which cause uterine bleeding. Each cause is studied by presenting the illustration previously used to demonstrate how that particular condition gave rise to this symptom in the study of that condition in the first phase of the work. The type of bleeding is now noted, and methods of diagnosis are discussed.

The following illustrations represent the charts used in demonstrating how some of the causes of uterine bleeding give rise to that symptom.

The significance of uterine bleeding is thus appreciated by the student and also that of the various types, i. e., whether or not connected with pregnancy, whether associated with menstruation or independent of it, whether scanty or profuse, frequent or infrequent, with or without pain, in young, middle aged, or those past the menopause. He furthermore appreciates how he should go about to make a diagnosis.

Let us consider the median symmetrical abdominal pelvic tumor as an example of an objective symptom which is well adapted to this method of teaching. This is best shown by studying the five illustrations (Figs. 15–19) which represent the charts used in demonstrating how four common causes of this symptom give rise to it.

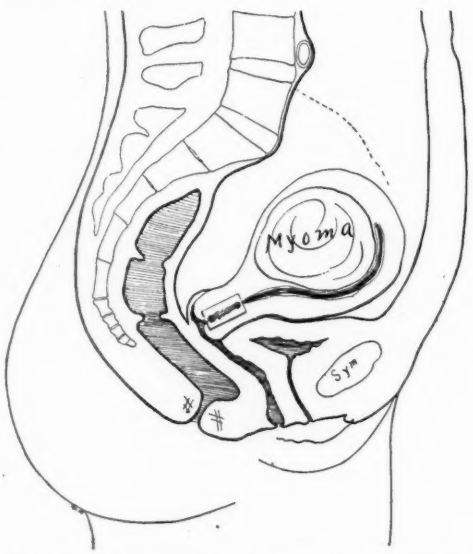

Fig. 8. Illustration of chart representing a symmetrically enlarged uterus containing a submucous myoma.

This is the same chart illustrated by Figs. 1 and 2, except that a piece of cardboard representing a uterus containing a submucous myoma has been inserted in place of the others.

The problem is presented in the same way as the one shown in Fig. 2.

By this and other methods of illustration, other types of uterine myomata may be presented to the class as illustrated problems. See Fig. 18, which is an illustration of another chart used in the study of uterine myomata.

The chart represented in this illustration may also be used in the study of other conditions than uterine myomata by inserting pieces of cardboard representing these conditions in place of the one shown in the above-mentioned illustration.

The student thus sees how the various conditions which may give rise to a median symmetrical abdominal pelvic tumor cause it, viz., by occupying that part of the body. He also appreciated how these conditions may be detected.

In like manner the other subjective and objective symptoms may be studied; but all are not as well adapted to this method as the two just presented.

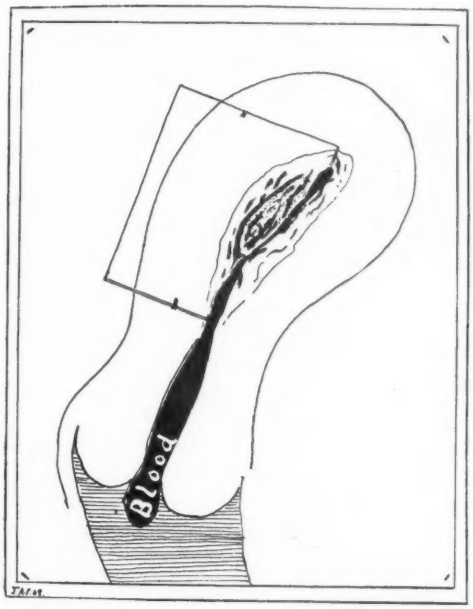

Fig. 9. The significance of uterine bleeding. Illustration of chart demonstrating how a polyp causes "menorrhagia."

This is the same chart shown in Figs. 6 and 7, and in place of the cardboard representing a submucous myoma, as shown in Fig. 7, one representing a polyp has been substituted. The same chart was used to demonstrate the origin of uterine bleeding in the study of uterine polypi in the first phase of the work.

The problem is presented to the class and solved by asking such questions as these: 1. How does a uterine polyp cause "menorrhagia." 2. What is the type of the bleeding? 3. How can a diagnosis be made?

The piece of cardboard showing the polyp may be substituted by others representing a submucous myoma (as already shown), a portion of retained placenta, hypertrophy of the endometrium, and cancer of the body of the uterus. Each of these conditions often give rise to the same type of bleeding, i. e., a "menorrhagia," and each may be presented and studied as the one just shown.

Fig. 10. Illustration of chart demonstrating the source of "irregular menstruation" in tubal pregnancy.

This is the same chart shown in the preceding illustration. The piece of cardboard representing the polyp has been removed and a piece of cardboard representing a tubal pregnancy has been inserted in a slip made to receive it.

This problem is presented and solved as the preceding one, i. e., by asking such questions as these: 1. How does tubal pregnancy cause uterine bleeding? 2. What is the type of the bleeding? 3. How can a diagnosis be made?

THIRD PHASE, THE STUDY OF THE ART OR TECHNIQUE OF GYNECOLOGY

Proficiency in this art, whether in "taking histories" or detecting the manifestations of altered anatomy and altered physiology (physical examination) or carefully considering each datum obtained and from this consideration determining the condition present (making a diagnosis) or treatment, requires actual clinical experience on the part of the student in the dispensaries, wards of our hospitals, and in private practice. I believe that this phase of the subject is best taught by dividing the class into small groups of two or four men — two if feasible — and permitting them to study the cases in the dispensaries and wards of our hospitals. Charts, models, specimens, etc., are also of great value in this work as a means of

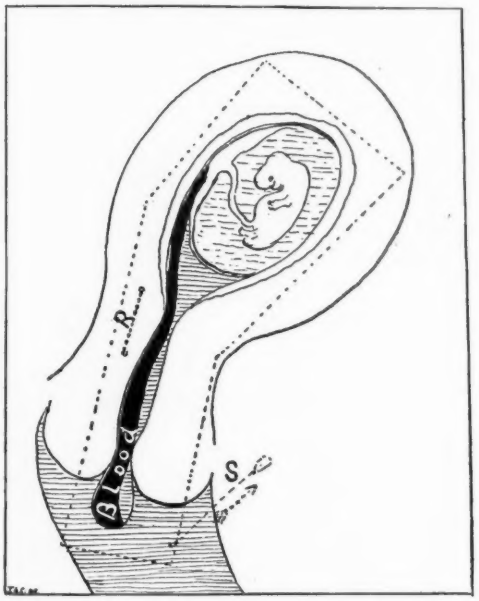

Fig. 11. Illustration of chart demonstrating the source of uterine bleeding in threatened abortion.

The chart is the same size as the preceding ones and represents the uterus in sagittal section. The uterine cavity and portion of the vagina have been cut out, and back of this chart is placed a piece of cardboard (see dotted lines) on which is represented the contents of the uterus and vagina which have been cut out. The rest of this piece of cardboard is painted red (black in illustration) to represent blood. The cardboard is held in place by a rubber cord (R), and a piece of string (S) is attached to its lower right hand corner. When the piece of cardboard is in place one sees the pregnant uterus in sagittal section and no evidence of bleeding, but on pulling the string, as indicated by the arrow, the cardboard is pulled to one side, thus separating the placenta from its attachment to the uterus, and the portion colored red appears as shown in the illustration by the black ink.

This chart is studied as the preceding one.

demonstrating the probable origin of the symptoms present in a given case and also enabling a comparison with other conditions. I have a series of casts representing the various conditions appearing about the vulva and perineum — as new growths, cystocele, rectocele, and prolapsus — and another series representing various conditions of the cervix. I have used various material in making these casts, as plaster paris, clay, "plasticine," wax, printer's roller composition and rubber, each having its own field of usefulness.

Case-teaching gives practice in the process of reasoning so essential in making a diagnosis and it is particularly applicable in teaching gynecology where clinical material is often inadequate.

The method of presenting abnormal conditions as illustrated problems may also be used in examinations, as for example, the mid-year

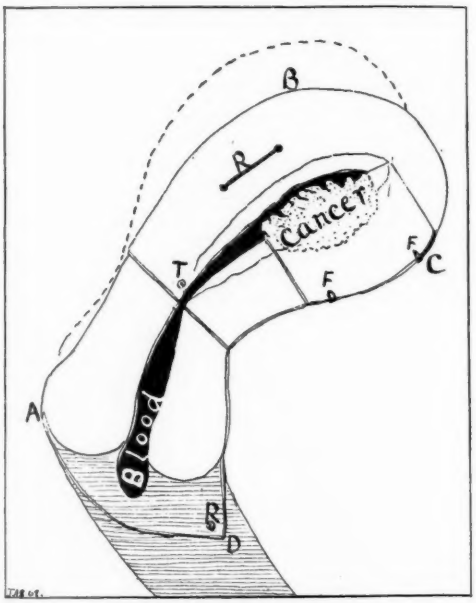

Fig. 12. Illustration of chart demonstrating the source of uterine bleeding in early cancer of the body of uterus.

The uterus and portions of vagina, A B C D, consist of two pieces of cardboard fastened together by a rivet (T) at the level of the internal uterine os. The cardboard uterus is attached to the chart by the rubber cords R R. The rivet and rubber cords permit the uterus to be moved about as occurs in straining, etc. The uterine cavity has been cut out as in the preceding illustration and the chart, just behind the portion that has been cut out (uterus in normal position), is colored to represent the uterine cavity, while just about this area the chart is colored red (black in illustration).

When the uterus is in normal position, as indicated by the dotted lines, there is no evidence of bleeding, but on pushing the uterus downwards and increasing the anteflexion, as may occur in straining, the uterus is displaced so that the red (black in illustration) appears in the uterine cavity and portion of the vagina which has been cut out and thus bleeding is indicated.

The chart is studied as the preceding ones. See Fig. 10. The piece of cardboard representing the cancer is held in place by two clips F F, and other pieces of cardboard may be substituted representing other conditions, as in the chart illustrated by Fig. 9.

examination in gynecology this year, for the senior class of the Albany Medical College, consisted of a life size representation (shown in sagittal section) of the conditions found in an actual case. The conditions present were a dermoid cyst of the right ovary situated anterior to the uterus and extending as high as the umbilicus; two cervical polypi were also present and the pelvic floor had been injured in childbirth with a resulting cystocele and rectocele. The members of the class were asked to solve the problem as indicated in Fig. 20.

The question naturally presents itself, What has been the result of this "problematic" method of teaching? I have used it for two years and feel that it is still in its experimental stage and is capable of greater development. I believe that I handled the subject better this year than last year and hope to improve it in succeeding years. The results of this method, at the end of the first year, encouraged me to place the illustrated problems in book form, so that the students might study them before discussing them in class and also that each one might have, at the end of the course, a book for future reference. Many of the illustrations in the book are reproductions of the illustra-

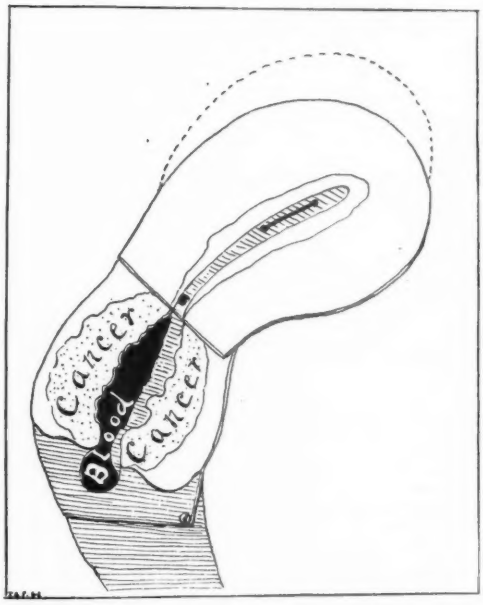

Fig. 13. Illustration of chart demonstrating the source of uterine bleeding in cancer arising in the cervical canal.

The chart is very similar to the one represented in Fig. 12, except that the uterine cavity has not been cut out but only the cervical canal and portion of the vagina.

When the uterus is in its normal position as indicated by the dotted lines there is not any evidence of bleeding, but when it is pushed downwards and its anteflexion is increased, as in straining, the uterus is so displaced that the red (black in illustration) appears in the cervical canal and portion of vagina which has been cut out. Bleeding then arises when the patient strains, thus bending and cracking the friable cancerous tissue.

The chart is presented and studied as the preceding ones. See Fig. 10.

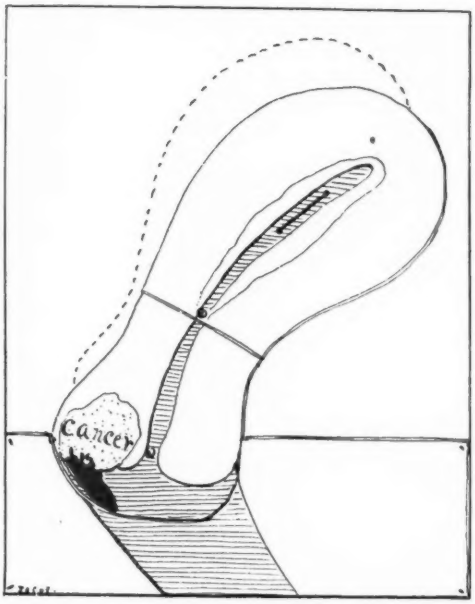

Fig. 14. Illustration of chart demonstrating the source of uterine bleeding in an early "inverting" cancer arising in the vaginal portion of the cervix.

The chart is very similar to the one represented in Fig. 13, except that only a small portion of the vagina is cut out as shown in the illustration by the black area.

When the uterus is in its normal position as indicated by the dotted lines there is no evidence of bleeding, but on pushing it downwards, red (black in the illustration) appears in the portion of the vagina cut out. This chart suggests that in this type of cancer the bleeding is apt to occur on straining when the cancer is injured by compressing it or forcing it against the posterior vaginal wall and it also suggests that the bleeding is slight and inconstant.

The chart is presented and studied as the preceding ones. See Fig. 10. Eversion of the cervical mucosa due to laceration, cervical polypi, and also other types and stages of cervical cancer can be presented in like manner.

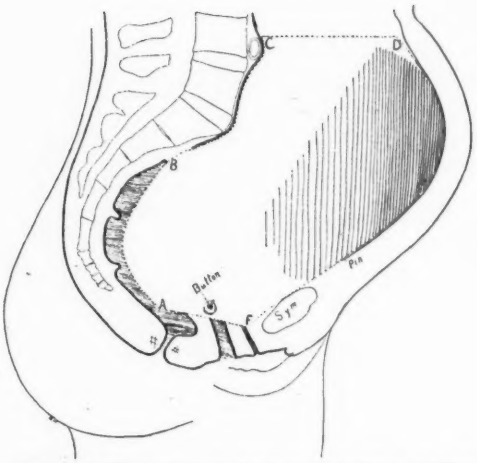

Fig. 15. Illustration of chart representing a median symmetrical abdominal pelvic tumor whose cause is not apparent.

The chart from which this illustration was made represents the lower abdomen and pelvis in sagittal section. As indicated in the illustration, a median abdominal pelvic tumor is present but the cause is not apparent. The area A B C D E F, which might be occupied by such tumors, has purposely been left vacant.

The class is asked what conditions, which they have studied, may give rise to such a tumor. Each of these conditions is studied by inserting a piece of cardboad representing the condition, which fills the area A B C D E F, and thus completes the picture and gives the explanation of one cause of a tumor of this kind in this situation. See next illustration. The button, held in place by a rubber cord and the pin are for the purpose of holding the pieces of cardboard in place which are to complete the picture.

tions used in presenting the problems. Each illustration in the book bears an explanatory legend and is accompanied by questions which indicate how the problem should be solved. Space is left after the questions for answers and notes which, when filled, should constitute our present knowledge of the subject. It is not intended that the book should take the place of the charts and other methods of illustrating the problems, mentioned in this paper, but to supplement them. The subject-matter of the book has been so arranged that each advance is a natural outgrowth of what has preceded. As a result of the use of this book, each student will have studied and in a measure written and indexed a treatise in gynecology and one that he may not only use as a reference book but to which he may add new material at any time. I have called this work "Studies in Gynecology Presented in the Form of Illustrated Problems for Class-room Work." It is published by he Brandow Printing Company, of Albany, N. Y.

The remarks made in regard to the "problematic" method as a whole likewise apply to this book, i. e., it is in its experimental stage.

In closing, I wish to emphasize what seems to me to be the chief advantages of teaching gynecology along the lines which I have endeavored to present in this communication.

Fig. 16. Illustration of chart showing how pregnancy causes a median symmetrical abdominal pelvic tumor.

This is the same chart represented in the preceding illustration but the area A B C D E F has been covered by a piece of cardboard of the size and shape of the area and representing a pregnant uterus. This piece of cardboard is held in place by the button and pin mentioned in the previous illustration. The picture shown in the previous illustration is thus completed and demonstrates how pregnancy may give rise to a tumor in this situation. This chart was used in the study of pregnancy in the first phase of the work and then the problem, of pregnancy at this stage, was solved by asking such questions as these: 1. Describe the condition present? 2. Does it interfere with the function of any of the pelvic structures or with the general well-being of the individual? and if so, how? 3. What manifestations of altered anatomy and altered physiology may be noticed by the patient? i. e., what are the subjective symptoms? 4. What manifestations of altered anatomy and altered physiology may be detected by the physician? i. e., what are the objective symptoms? The chart demonstrates that one of the most important objective symptoms of pregnancy is the median symmetrical abdominal pelvic tumor.

The present problem of the significance of a median symmetrical abdominal pelvic tumor is now partly solved by asking such questions as these: 1. How does pregnancy cause a median symmetrical abdominal pelvic tumor? 2. What is the type of tumor, i. e., describe its physical characteristics? 3. How can a diagnosis be made?

1. By studying the subject in the three phases mentioned, the student should develop an excellent foundation for his future clinical work. In the first phase he learns how the normal becomes abnormal and studies the abnormal conditions of disease as seen in the pathological laboratory and sees how the various symptoms arise. In the second phase he studies the significance of the various symptoms caused by the abnormal conditions studied in the first phase and learns how these conditions may be differentiated. He is thus prepared to begin the third phase with a clearer understanding of the various causes of the symptoms he is about to learn the art of detecting and with a clearer insight into diagnosis and treatment, because he has a clearer conception of the conditions which may be present, how they arose, how they cause symptoms, and what these symptoms may be. In the third phase he should be taught the art or technique of physical examination, diagnosis, and treatment, by actual contact with the patient in the wards and dispensaries of our hospitals.

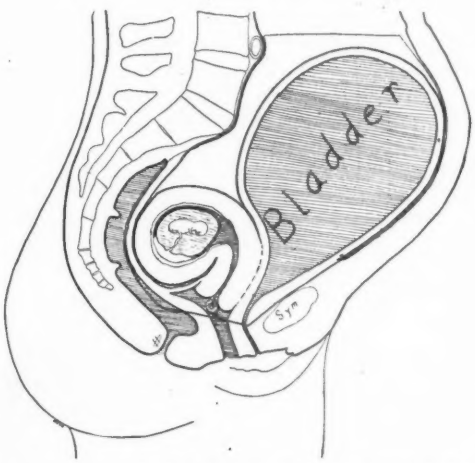

Fig. 17. Illustration of a chart showing how a full bladder causes a median symmetrical abdominal pelvic tumor.

This is the same chart represented in the preceding illustration except that the piece of cardboard, representing a normal pregnancy, has been replaced by one representing a full bladder caused by a retroflexed pregnant uterus (from an actual case). This completes the picture and shows how this condition causes a tumor in this situation.

This problem is presented and solved as was the preceding one.

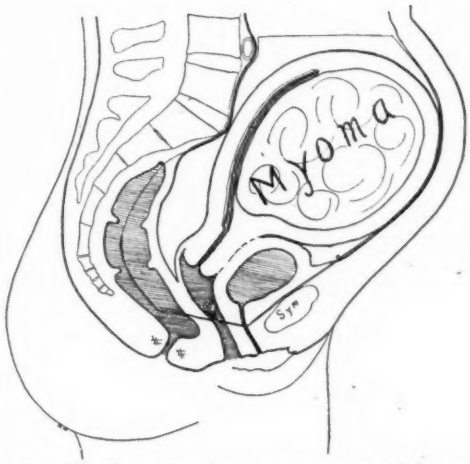

Fig. 18. Illustration of a chart showing how a uterine myoma may cause a median symmetrical abdominal pelvic tumor.

This is the same chart represented in the preceding illustration, except that the piece of cardboard representing a full bladder has been replaced by one representing a myomatous uterus. This also completes the picture and shows how this condition causes a tumor in this situation from an actual case). The chart thus completed was used in the study of uterine myomata in the first phase of the work and then the problem of this condition was solved by asking the questions asked in Fig. 2.

The present problem is now presented and solved as were the two preceding ones. See Fig. 16.

2. By working out, himself, the correlation between normal anatomy, normal physiology, and the manifestations of these on the one hand, and altered anatomy, altered physiology, and the manifestations of these on the other, he realizes that all symptoms of disease are but manifestations of normal anatomy and normal physiology as altered by some abnormal condition. He, therefore, knows when an abnormal manifestation is present that there is an abnormal condition causing it, and that it is the cause which demands his attention; and, furthermore, he knows that he should determine the cause from his knowledge of normal anatomy, normal physiology, the manifestations of these, and a knowledge of the changes caused in the above by the various pathological processes called disease.

3. By arranging the subject so that each step is but a further development of preceding ones and by showing how the various conditions, occurring in the course of each disease,

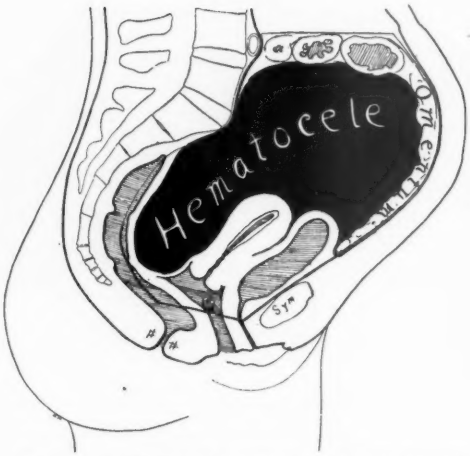

Fig. 19. Illustration of a chart showing how a hæmatocele may cause a median symmetrical abdominal pelvic tumor.

This is the same chart represented in the preceding four illustrations with a piece of cardboard representing a hæmatocele covering the area A B C D E F. This piece of cardboard completes the unfinished picture, shown in Fig. 15, and shows how a hæmatocele may give rise to a median symmetrical abdominal pelvic tumor (from an actual case). The chart thus completed was used in the study of this condition in ectopic pregnancy.

The problem is presented and solved as were the three preceding ones. See Fig. 16.

In like manner other causes of this symptom may be presented and solved, such as an ovarian cyst, pelvic abscess, abdominal pregnancy etc.

Similar charts may be used to study the significance of tumors in other situations.

arise and by presenting these conditions as *illustrated problems* which the student can see and touch, he is able to use these special senses, and with his knowledge of the subject he attempts to solve these problems himself. The students' answers corrected, when necessary, and supplemented by information which they cannot be expected to reason out, should constitute our present knowledge of the condition under discussion.

4. By means of special "mechanical" charts, the development of many abnormal conditions may be indicated, the conditions resulting may be shown diagrammatically and especially with a view to the explanation of how these conditions alter the manifestations of normal anatomy and normal physiology, i. e., how they give rise to symptoms and what these symptoms are.

5. By presenting these problems in book form the student is able to study them before coming to class and at the end of the course has a text-book for future reference.

6. By following out this general plan of instruction each student will have been taught to observe, to use what knowledge he already has in solving problems new to him, and will have studied and, with assistance, solved the various problems in gynecology instead of memorizing data obtained from didactic lectures and text-books. In addition, he will have written a text-book which he not only had for future reference but also one to which he may add new material at any time.

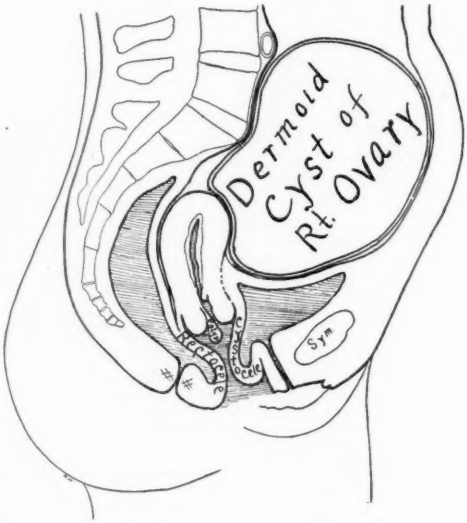

Fig. 20. Illustration of chart used in mid-year examination in gynecology.

The students were told the conditions present in an actual case and the case was presented to them as an illustrated problem which they were asked to solve by answering these questions:

1. How did the conditions present in this case probably arise?
2. What would be the probable subjective symptoms and their origin?
3. What should be detected on examining the patient?
4. What other conditions might simulate the ones shown here?

It may be seen that, in order to answer these questions, quite an extensive review of the subject of gynecology must be made and that the conditions presented were those found in an actual case and also those which will be encountered by the students in their future clinical work.

VENTROSUSPENSION AN UNSAFE OPERATION FOR POSTERIOR DISPLACEMENT OF THE UTERUS DURING THE CHILD-BEARING AGE[1]

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SINCE the paper of Noble, entitled "Suspensio uteri with reference to its influence upon pregnancy and labor," presented to the American Gynecological Society in 1896 and appearing in its printed transactions for that year, it has been recognized that a firm fixation of the uterine fundus to the anterior abdominal wall is followed, in a certain number of patients who subsequently become pregnant, by a dystocia perhaps so marked as absolutely to indicate Cæsarean section.

For the present discussion two varieties of attachment of fundus to abdominal wall are recognized:

1. *A ventrofixation*, in which the fundus is sutured firmly to the anterior abdominal wall, the sutures passing through peritoneum, fascia, and muscle in addition to including a portion of the fundus.

2. *A ventrosuspension*, as recommended by Kelly, in which the sutures, aside from including a portion of the posterior wall of the fundus, pass through only the peritoneum and subperitoneal tissue of the abdominal wall, the object of this operation being the formation of a suspensory band or bands which will allow mobility of the uterus but not retroversion of it.

On looking over the literature of the subject, it is found almost impossible in many cases to determine whether the original operation for retroversion was intended to be a ventrofixation or a ventrosuspension. It is well known that in many cases in which a ventrofixation has been performed, i. e., fundus firmly sutured to muscle and fascia of abdominal wall, the adhesion between fundus and wall has subsequently stretched so as to allow mobility of the uterus and the result of the operation has been really a suspension.

On the other hand, it is the desire of the writer to emphasize the fact that an intended ventrosuspension may become a ventrofixation in ways which will be discussed later.

The anatomical results of pregnancy in a uterus firmly fixed to the anterior abdominal wall are fairly uniform:

1. The only part of the uterine body which develops and expands to accommodate the growing fœtus is that behind the point of suture attachment to the abdominal wall.

2. The part of the uterine wall in front of and below the point of suture attachment thickens and hypertrophies, even to the extent in some cases of producing a muscular tumor obstructing the parturient canal.

3. The part of the uterine wall behind the point of suture attachment may become so thinned during pregnancy as to rupture during labor. This has been reported in at least six cases by Von Guérard, Dickinson, Brodhead, Clark and Bowley, Edebohls and Ingalls.

4. The cervix is thrown upward and backward so that at full term it may be at the level of or above the promontory of the sacrum.

These are the anatomical results of pregnancy in a uterus the seat of a ventrofixation which has continued as such during the pregnancy, and, as has been suggested by Noble, the farther backward on the posterior uterine wall the suture attachment is made, the greater the maldevelopment of the uterus in pregnancy and the greater the resulting dystocia.

The forms of dystocia which have been most commonly met with are:

1. A malpresentation of the child, especially a transverse presentation. This transverse presentation was noted in fifteen of the twenty-one cases of Cæsarean section for this condition collected by Lynch and occurred in all five of the cases operated on by the writer and here reported.

2. An ineffectual labor with cervix undilated and high up. This high position of the cervix

[1] Read before the American Gynecological Society, Philadelphia, May 26, 1908.

is noted in most of the cases demanding Cæsarean section and was present in all of my cases.

3. An obstructed labor, the obstruction being produced by the thickened anterior uterine wall.

It is freely admitted that many patients upon whom a ventrofixation has been performed have passed through pregnancy and labor without dystocia resulting therefrom. Up to three years ago, it was my custom to perform ventrofixation or ventrosuspension for posterior displacement needing operation and my records show seventy cases of ventrofixation or ventrosuspension, mostly the former, in which at least one ovary and tube were left and hence the possibility of pregnancy preserved, yet so far as is known to me no dystocia has occurred in these cases, perhaps because the fixation sutures did not pass posterior to the center of the fundus.

However, including the five cases reported in this paper, there are now at least forty cases of Cæsarean section on record which were demanded by a previous ventrofixation of the uterus. The profession is certainly ready to accept the statement that ventrofixation is an unsafe operation for a posterior displacement of the uterus during the child-bearing age.

Let us now turn to the question of ventrosuspension.

Inspired by the favorable reports from this operation as performed in Kelly's clinic (Holden's investigation of 900 cases showing 83 subsequent pregnancies and no serious dystocia), many operators are performing ventrosuspension under the impression that slight if any dystocia will result if pregnancy follows. The object of this paper is to call attention to the fact that a ventrosuspension is not a safe operation during the child-bearing age, for the reason that an intended ventrosuspension may become a ventrofixation in one or other of the following ways:

1. The area of adhesion between uterine fundus and abdominal wall may be broader than expected and the resulting band be too firm to allow uterine mobility.

2. Infection of the abdominal wound may fix the fundus and anterior uterine wall firmly to the abdominal wall.

3. A ventrosuspension which allows a normal delivery in the first pregnancy following operation, may subsequently become a ventrofixation and produce dystocia so marked as positively to indicate Cæsarean section in the second postoperative pregnancy.

In the five cases of Cæsarean section necessitated by ventrofixation, which the writer now desires to place on record, the operations for the retroversion were all performed by different men, and, save in the fifth, it is not known whether a suspension or a fixation was intended.

The Cæsarean sections were all performed at the Sloane Maternity Hospital, N. Y. In the first case the firm fixation was evidently due to suppuration of the abdominal wound. This was shown by the broad cicatrix.

The histories and conditions found in the first four cases are so similar to those frequently reported that details will not be given.

The fifth case presents many interesting features and is an important factor in support of the statement which forms the title of this paper.

CASE 1. Mrs. G., age 27, birth No. 7285. Ventrofixation or ventrosuspension for retroversion performed four years before admission. Child lies transversely; cervix high posteriorly; anterior uterine wall forms muscular tumor blocking parturient canal. Cæsarean section performed May 30, 1898. Firm adhesions bound fundus and anterior uterine wall to anterior abdominal wall.

CASE 2. Mrs. W., age 29, birth No. 13314. Ventrofixation or ventrosuspension two years before admission. Cervix high up posteriorly; head in right iliac fossa. Cæsarean section performed February 21, 1903. The posterior uterine wall was found attached to anterior abdominal wall by a firm adhesive band about two inches long and one-half inch thick, its uterine attachment being about two inches posterior to the middle of the fundus.

CASE 3. Mrs. L., age 36, birth No. 19462. Ventrofixation or ventrosuspension performed several years before admission; child lies transversely; cervix lies high up to the left near level of umbilicus. Cæsarean section performed April 17, 1907.

CASE 4. Mrs. S., age 32, birth No. 20367. Ventrofixation or ventrosuspension performed four years before admission; child lies transversely, cervix high up, delivered by Cæsarean section October 23, 1907.

CASE 5. Mrs. S., age 26, birth No. 21080. In October 1902, a very able New York surgeon, realizing full well the obstetrical dangers of a ventrofixation, performed with great care a ventrosuspension for retroversion of the uterus. She was much benefitted by the operation and in March 1903, about five months after the ventrosuspension, she became pregnant. On December 5, 1903, she was delivered by the writer after

a very easy and rapid labor. Her first stage began with rupture of the membranes at 8 P.M., just as she was starting for the theater. The baby was born at 10:30 P.M. The position was L. O. A.

It was thought by the surgeon who performed the operation, by her attending physician, and by myself that the ventrosuspension had been a marked success and that no obstetrical complication from it need longer be feared.

In June 1907, patient became pregnant again and on the eve of March 26, 1908, the writer was again called to deliver her. On examination, the following conditions were found:

The cervix was high up posteriorly and with difficulty reached. The child lay transversely and the anterior uterine wall was thickened as in the preceding cases. As no progress had been made on the following morning, she was taken to the Sloane Maternity Hospital and Cæsarean section performed by me soon after her arrival. The suspension band, which in the first postoperative pregnancy allowed such normal uterine development and such a normal delivery, had in this pregnancy become thick and unyielding. Whether as a result of the puerperal involution at the former labor (the puerperium was afebrile), or as a result of the present pregnancy, I know not. The condition was that of a ventrofixation and a Cæsarean section was the positive indication.

If a ventrosuspension which in 1903 allowed a normal pregnancy and an easy labor can in 1908 become a ventrofixation requiring a Cæsarean section, it seems to the writer that the profession should accept the statement that ventrosuspension is an unsafe operation for posterior displacement of the uterus during the childbearing age.

In the five Cæsarean sections reported in this paper the mothers all recovered.

The baby in Case 3 died on the fourth day of multiple hæmorrhages.

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SOME OBSERVATIONS ON ACUTE AND CHRONIC APPENDICITIS

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AS much time has elapsed since 1824, when it was definitely settled that the appendix was susceptible to disease and as so much has been written about this little organ, it is not without much temerity that I venture a few remarks based on 527 cases operated on. There will be no attempt at a full report of the cases at this time, as many of the reports are incomplete, but a general *résumé* of what has impressed the writer in this series of cases.

There occurred 189 acute cases; of this number there were 69 in which pus had formed. The abscesses ranged in size from a few drops to as much as one-half pint, this being the largest that was encountered in the cases operated on early. It might be stated that there were 132 cases operated before the fourth day of their attack, and all the acute cases were operated on during their first attack.

Of the chronic cases, there were 338; of this number pus was found in 56 in varying amount, the quantity usually being small and held in by dense adhesions.

The remaining 282 cases presented the picture of appendix imbedded in adhesions which bore evidence of the patients' having had several attacks.

Age. The ages of these patients ranged from 5 to 83 years. The majority of cases occurred between the years of 15 and 45 and not often encountered after 60.

Sex. The males were more frequently the victims than the females, as 359 were males and 168 females. It will be seen that these figures correspond to those given by Kelly who in speaking of sex, quotes 86 cases of

which 57, or 66 per cent, were males and 29, or 33 per cent, were females.

Symptoms. It is interesting to note the variations of symptoms in these cases. Pain was present in all cases but varied in intensity and location. In some of the cases the pain was not intense, while in others it was out of proportion to the condition found at operation. Two cases are remembered with great distinctness, as the appendix in both cases was gangrenous and the patients, who were male adults, did not complain when considerable pressure was made.

The location of the pain varied somewhat, but not so much as the severity, as fully 90 per cent of all cases had pain in the right iliac fossa at some time during the attack. It would be centered around the umbilicus in many cases only to be more pronounced later in the right iliac region.

It was noticed that some patients complained of pain in the left lower abdomen, also in right lung. It was particularly noticed that when pain was pronounced in the right lumbar region, it was usually associated with pus or a badly diseased appendix. This was so prominent that it was found in about 60 per cent of the 125 pus cases, acute and chronic.

Rigidity of muscles. Next to pain this is perhaps the most reliable early symptom and is always indicative of inflammation, more especially unilateral rigidity; when rigidity is unilateral and limited in area it is all the more suggestive of mischief. In a series of 68 cases, acute and chronic, it was present in 62; the remaining 6 cases were not seen until quite late in the attack and they, in all probability, had had it.

Nausea and vomiting are symptoms that are usually met with at the outset of the attack; these symptoms were noted 11 times in 84 cases in which careful records were kept. The records show that in some of the worst cases of nausea and vomiting, the appendix was not very badly diseased nor was there much peritoneal involvement.

Temperature and Pulse. Too much reliance must not be put in the temperature in a given case as this symptom, like the pulse, carries much weight only when considered along with other symptoms. In the two cases above referred to, the pulse and temperature gave no clue as to the exact condition within the abdomen, as temperature and pulse may be subnormal in suppurative appendicitis.

In only 8 cases was a leucocyte count made, and in all was there a leucocytosis above 1,500,000. This may be of great help to the surgeon, but it should not be relied on to the exclusion of other symptoms. Appendicitis may be associated with other diseases as it occurred with tubercular peritonitis in 2 cases. In both of these cases it was not suspected at the time of the operation. Both cases were of the type that would have required operative treatment. In these two cases no history of tubercular trouble could be had, as both were adult males. The only history that was suggestive was in one case where there had existed for some months a colitis with mucous stools.

Pleurisy occurred in 7 cases, and in all seemed to mask the symptoms at first. In one of these cases, there was a subphrenic abscess; and in one other case there was a general peritonitis. These pleurisies were in all probability septic in character and seem to increase in severity in proportion to the toxæmia.

Post-typhoid appendicitis does exist and much more often than one is disposed to believe. It occurred in 6 cases; in all six there was pus in varying quantity.

Pregnancy occurred in 2 cases; one occurred at 4 months the other at 6½; the one at 4 months was acute catarrhal and recovered; the other was gangrenous, dying on the eleventh day after miscarrying, the first case going to term safely.

The treatment employed in the majority of these cases was as follows:

Gridiron incision in 123 cases.

Kammerer skin incision in 86 cases.

Deaver incision in 118 cases.

Lumbar incision in 2 cases.

In all abscess cases, the abscess was incised and drained, and in only 3 cases was the appendix removed; one of these died on the ninth day of general peritonitis.

The lumbar incision was employed in 2 cases, as it seemed that better drainage could be had.

The treatment of the stump in appendicitis has of late been given considerable attention with a view to find which method

gives the best results. There are many ways that the stump may be treated, but I believe that the profession, with few exceptions, have about agreed that simple ligation with excision and sterilization gives as good results as any method yet devised.

I shall mention only those methods that were used in the 527 cases operated on. No records were kept as to the number operated on by each method.

1. Ligation, excision, and sterilization of the stump.
2. Fowler's method.
3. Dawbarn's method.
4. Edebohl's method modified.
5. Skene's, Kelly's and Eastman's methods.
6. Beck's method.

The method used more than any other was ligation, excision, and sterilization, as this gave good results and reduced to the minimum the danger of hæmorrhage and a leakage from the bowel.

The next method that was used quite a bit was Dawbarn's. It gave good results but required a little longer time for its performance. The modified Edebohl's method was used in a few cases, but was soon abandoned because of losing one case by hæmorrahage — a male adult of 17 years that died from failure properly to include the artery; this was found to be the case at autopsy. Then another thing: there is no good reason why the appendix should be invaginated with its distal end floating free in the fæcal current. One might see how the appendix would be long in sloughing off and give rise to trouble. The only thing that commends itself in this operation, is the fact that the lumen of the bowel is not opened.

In a few of the early cases, Fowler's and Beck's methods were used, but I failed to see wherein these methods were superior to the more simple one of ligation and excision.

Skene's, Kelly's and Eastman's methods were employed in a very limited number of cases, but were abandoned for the safer and simpler one above mentioned. The method of cutting the appendix flush with the bowel, was practised in a few selected cases. In cases where the appendix is very much inflamed and œdematous, and where there are chances of a ligature around its base not holding, it is better to use this method and close the opening in the bowel with Lembert sutures.

The majority of these cases ran a regular course, the wound healing kindly, save in a few instances, and being out of bed in from 12 days to 3 weeks. The exceptions to the above were cases which presented complications not commonly met with, as follows:

Hæmorrhage from the stump as above mentioned.

Subdiaphragmatic abscess.

Phlebitis.

Sloughing of the scrotum.

Abscess located in the left iliac fossa, the appendix being hung across the abdomen.

Ileus.

Acute yellow atrophy of the liver.

Subdiaphragmatic abscess followed the operation in 2 cases; one died in 10 weeks after the operation from septicæmia, after the abscess had been located and drained. The other case recovered after 8 weeks' residence in the hospital, a sinus remained in this for about 3 weeks longer; this healed and has since given no further trouble.

Phlebitis occurred in one case, that of a man who had been suffering for 8 days with appendicitis, and had when admitted to the hospital, a large abscess. After the operation, which consisted in opening the abscess and draining, he did well until the eleventh day, when he complained of his right leg. His leg began to swell and was very tender and presented all the symptoms of phlebitis — this after about two weeks finally passed off, leaving the leg a little tender but did not incapacitate him after he was allowed to get out of bed.

Sloughing of the scrotum occurred in one case. This was a boy of 19 years, who had been sick for about two weeks, and when he was admitted to the hospital he was very septic, chills, sweats, etc. He had a large mass in the right iliac fossa about the size of an orange. There was some swelling of the right leg.

The abscess was opened the same day of admission, and a large quantity of pus evacuated. The general condition of the patient improved somewhat, but it was noticed that the tenderness along the inguinal canal was quite marked; the external ring was swollen,

and the slightest attempt at the introduction of the finger caused the most intense suffering. In 6 days from the time the operation was performed, the pus had burrowed along the inguinal canal and had exposed the cord and had involved the scrotum so that the testicle was exposed. The cord and testicle were so damaged that removal was necessary.

The abscess was located in left iliac fossa near the median line, in one case. This occurred in a woman, age 40, who had had three attacks. The appendix was found stretched across the abdomen imbedded in adhesions. The appendix was found to measure 6½ inches in length and contained a large fæcal concretion partially sloughed through, the end of the appendix forming part of the abscess wall. Foreign bodies found in the appendix were as follows:

A piece of solder about the size of a pea was found in one case, that of a woman. It would be impossible to say whether or not the solder was the cause of the attack, as she had had one attack 5 years before. A small pin was found in one case; it was found imbedded in the wall of the appendix; this occurred in a young lady.

In the second case it looks more like the pin caused the trouble, as the patient remembered swollowing the pin about 4 months before and she said she had cutting pains in the bowels following; the pain she described as being most severe in the right side. This looks like the pin was the cause of the attack in this case, as she had had no previous attacks.

Some years ago foreign bodies were frequently ascribed as the cause of appendicitis; now we know that foreign bodies are not often found; and in the majority of instances, they play a subsidiary rôle in the causation of this trouble. Of all the foreign bodies found, the pin is perhaps more frequently found than any other. In 1000 cases operated on at the Johns Hopkins Hospital, Kelly says that foreign bodies were found in only 4 cases. Bell found foreign bodies in 5 cases out of 1000. There will always follow, in some cases of appendicitis operated on, certain untoward intraabdominal complications, which not only add additional gravity to the case, but often necessitate the reopening of the abdomen. This was the result in two cases, ileus being the cause in both. I believe that ileus is probably not more frequent after operations for appendicitis than after other abdominal operations, and that the obstruction is usually in or near the ileo-cæcal region.

The first case was a boy on whom I had operated; and while in the hospital but not out of bed, he was seized with pain in the abdomen. This became very severe and intermittent in character, he had the usual cardinal symptoms of obstruction. He was reopened and it was found that a loop of the ileum was adherent to a place on the cæcum that had been denuded. This caused a sharp angulation in the bowel.

This case recovered. He was operated on within the first 24 hours of the onset; the time of the operation was short as the trouble was easily located, hence the shock slight and the danger minimized.

The second case was a man who was taken ill 2½ weeks after the operation, with symptoms of obstructions; these became so pronounced that he was reopened and it was found that he had a band about 2 inches in length that tightly held the ileum. The bowel was in such a condition that a resection and anastomosis at the time was not advisable, owing to his condition, so it was carefully wrapped in gauze and brought outside the wound so that it might be properly repaired later when the patient's condition had improved, as I believe any radical operation in a case of this kind would have been fatal.

Acute yellow atrophy of the liver occurred in one case, that of a young lady aged 27. She was taken suddenly with pain in the abdomen which later settled down in the right side, rigidity of the muscles, nausea, vomiting, rise of temperature and pulse. The operation was performed within the first 30 hours of the attack. The appendix was not as much involved as the symptoms would indicate; it was in the acute catarrhal stage and was removed without much difficulty. The case did well until the fourth day, when the temperature and pulse began to rise and reached 103 and 120; the skin was slightly jaundiced; there was vomiting and restlessness. The jaundice was more pronounced; she became delirious; the urine contained bile, albumen and casts. She died on the seventh day from

date of the operation. Chloroform was used; the operation lasted 25 minutes.

The writer has on three occasions removed the appendix that was diseased, when the symptoms were those of other intraabdominal troubles. One case had symptoms pointing to stone in the kidney. Two had symptoms of gall-stones. The first was a man; the X-ray showed no stone in the kidney. The last two occurred in a man and woman. These cases when subjected to the X-ray did not show any gall-stones. The symptoms in all three cases passed off after the operation, showing conclusively that the trouble was undoubtedly in the appendix. The mortality in these cases was as follows:

Acute cases 13; chronic cases 5. Total number of deaths, 18.

SO-CALLED PHLEBITIS OF THE LEFT LEG

Following a Case of Appendicitis not Operated upon, with Some Theoretical Considerations of the Etiology of Postoperative Phlebitis

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As an introductory remark, I wish to state that no argument will be raised in this paper for or against the medical treatment of cases of appendicitis. The object is only to state the facts in the case, for they are of interest from two viewpoints: 1. The complication to be described seems, from the scant mention of it in the literature (1) and from conversation with my colleagues, to be very infrequent in appendicitis not operated upon; and, 2. From the facts adduced and from the nature of the case, I believe one may make certain theoretical deductions concerning the etiology of postoperative phlebitis.

The appendicitis occurred in a young man of 26, a bank clerk, coming on with localized pain, tenderness, vomiting, temperature, etc. On the evening of the third day, the physician was first called. No operation was decided upon, because from the history and physical examination the pathologic condition was believed to be such that well-formed adhesions were limiting the extent of the infection, the patient's condition, especially from the results of consecutive total and differential white cell counts, was adjudged satisfactory, and the operation, it was concluded, could with safety be postponed until the danger-free "interval." The white count which was at first 24,000, with 80 per cent neutrophiles, went progressively down until, on the seventh day of the disease, it was 9,000, with 65 per cent polymorphonuclears, which day was the first free from fever. On that day some pain was complained of in the back, which was attributed by the patient to the recumbent position and passed by lightly by the physician.

On the ninth day of the disease, the patient was sitting up. The treatment was rest in bed, rectal enema at the start, and then an absolute abstinence from all things by rectum or mouth, except teaspoonsful of water occasionally. After the temperature was normal, castor oil was given and feeding was begun, starting with small amounts of liquid, and gradually increasing to solid diet.

On the tenth day, 24 hours after the patient had had his first solid food, there was increased pain in the lumbar region, a "sore feeling," and a temperature of 102 and pulse of 124, with a soft abdomen free from any tenderness. Although some complication was felt to be certainly present, none could be demonstrated.

On the eleventh day, there was marked tenderness and pain in the groin, and a very tense, shining swelling of the upper half or third of the left thigh. The following day, the pain and tenderness extended down the leg to the popliteal space, with some pain in the calf but little, if any, descension of the swelling. From the thirteenth to the twenty-third day, the temperature was normal and at the end of this period,

the patient was walking around, but so much engorgement of the superficial veins of the calf and lower thigh resulted that an elastic bandage was applied. This gave much comfort and six months later the patient still wore it. The venous hyperæmia was practically gone then, but the left thigh was still larger than the right. Œdema of the pittible kind was never present in the thigh, calf, or foot and there was never any swelling, except in the upper half or third of the thigh. The patient had typhoid seven years before but had no complications. He has had no other disease, except what may be construed as a previous attack of appendicitis several years before, and there were no structural or pathologic changes other than those mentioned. No thrombus was ever palpated, but early in the case all attempts to do so were refrained from.

In the attempt to arrive at an explanation of such a complication, different authors have mentioned a great array of conditions. These, quite naturally, are those that may predispose to, or produce, the three cardinal causes of thrombosis, which still is assumed to be present even in those cases where no thrombus can be palpated. One author (2), in a recent summary, has gathered together a large number of such conditions which, of course, are concerned with surgical possibilities. Every medical man who has read upon this subject within the past few years, is too well acquainted with the numerous hypotheses advanced to require an enumeration of them here. Some objection might well be raised to the effect that the case discussed here was not operated upon, and consequently should come in a different class, but the onset of the complication and its clinical features tally so exactly with many of the postoperative cases, that, in the writer's opinion, they are of like nature.

Assuming this to be correct, certain conclusions are inevitable. Many of the conditions mentioned as contributory to phlebitis can be ruled out in this case. All those having to do with the actual operation and its preliminaries were not active. Further, the numerous factors producing local or general abdominal pressure, as heavy bandages, sigmoid pressure, tumors, and what not, may be excluded, for not even the comforting hot water bag was allowed upon the abdomen for fear of disturbing any limiting adhesions around the appendix; and the liberal enema at the beginning, and the free action of the bowels later, precluded any undue weight from the sigmoid flexure. Meteorismus was present soon after the first food was given and cannot be so easily passed over, but it was active for only part of a day. There was nothing else tangible to produce pressure and no general venous congestion obtained, for the heart, from physical examination, was normal. There had been no previous exhausting disease, no demonstrable feeble circulation and no anæmia, though it must be confessed that neither a red count nor a hæmoglobin estimation had been made. The man was strong and active before his appendicitis, and no indication was present for obtaining such data.

Going back to the general condition of slow circulation from abdominal pressure, a paper by Welch (3) seems to me to be to the point. In discussing venous thrombosis in heart disease, he states that the small liability to thrombosis under the conditions of heart disease (where slow, feeble, and irregular venous current would be the paramount factor) is one of many evidences that mere slowing of the blood current is not an efficient cause. In other places, Welch has evinced this same tendency. Besides this, experiments have shown rather conclusively (4) that thrombosis does not occur from blocking of the blood current. So that, though increased abdominal pressure may produce slowing of the blood current, it is very doubtful whether such a change in the circulation is actively a causative factor.

In fact, ruling out any undetermined changes in the blood state, a subject which is still in the problematic stage, the chief factor remaining is any infection which might produce changes in the vessel. Such infection certainly was present in the case of appendicitis described. In fact, the mere use of the term phlebitis by numerous authors describing these postoperative complications is an admission of an infection. Be that as it may, the temperature at the onset of the complication, in this case, the character of the complication (phlegmasia alba dolens, which is practically always a result of infection), and the existence

of a pre-existing cause in the infected appendix are all frank evidences of an infective cause.

The writer is not a surgeon and cannot discuss methods of removal of any organ. But he can not understand how appendectomies and hysterectomies (after which a large proportion of postoperative phlebitis occur) can possibly be made strictly aseptic. Every appendiceal stump, no matter how handled, and every opening into the vagina, no matter how thoroughly disinfected, must necessarily let free into the peritoneal cavity some bacteria of greater or lesser virulence. Infection of some grade, as a cause for phlebitis, etc., is ever present, then, with the most approved technique. Though the peritoneum is resistant to infection, certain conditions predispose to it, such as foreign bodies, ligated or strangulated areas (5), the presence of blood (6), and the so-called dead spaces of Mikulicz (7). A paper by Wakefield (8) is also to the point. This author did not intend to describe exudates of infectious origin, but from the fact that exudates are commonly due to microorganisms, these might well be of mildly infectious origin in spite of a good convalescence, for the actual pathologic effects produced by bacteria depend upon various conditions (9). The well-known fact, too, that many of the reported cases of thrombosis, even with autopsy, are not examined culturally, and the frequency with which thrombi have been found to contain bacteria (10), are all much-discussed considerations to be weighed.

Concerning the route of infection, the lymphatic is the one that appeals to the writer. He will show elsewhere that many of the reported cases of postoperative phlebitis are really phlegmasia alba dolens, and are, therefore, lymphatic in origin. It may as well be that the primary thrombotic forms are likewise of that nature, without the massive involvement of the structures outside of the vein. Kaufman (11) states, in large type, that phlebitis is a lymphangitis of the walls of the vein. It is, of course, known that some phlebitis of the vein may exist without thrombosis (12), but given a thrombus, the most likely general cause is a phlebitis.

In a paper on Lymphatic and Hepatic Infections, Munro (13) speaks of the great frequency of infection of lymph channels after appendicitis and says that such condition may be started early in the case. Evidence of this is seen in the mesenteric lymph nodes, and Lockwood (14) believes that the main route from the appendix and cæcum is to the retroperitoneal lumbar glands. Munro gives some autopsy and clinical reports showing such lymphatic enlargement after appendicitis. Morris (15) has given as his opinion that the infection is by way of the peritoneal lymphatics. In a case of appendicitis, it would not be improbable before operative interference for infection to have reached the lumbar glands, which an appendectomy could not remove. Given such a pathologic state, there would be two possible ways for the lymph to be conducted. In the usual course, the path would lie upward toward the receptaculum chyle, but, in a spreading infection, it could be in all directions, giving us the picture Virchow called internal erysipelas, which could lead either to a phlegmasia alone, or to phlebitis and thrombosis.

There certainly can be no question of the infectious nature of true phlegmasia alba dolens, which is described by De Lee (16) properly as a swelling of the upper part of the thigh, and of lymphatic origin, and included by practically all obstetricians among the complications of puerperal sepsis (17).

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13. Annals of Surgery, vol. 42, p. 692.
14. Quoted by Munro.
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17. Cf. Keim, Presse Médicale, vol. 15, p. 56.

THE FACTOR OF MORTALITY IN THE OPERATION OF HYSTERECTOMY [1]

With Report of 105 Cases

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THE object of this paper is to consider the factors which have a direct bearing upon the operative mortality in hysterectomy. The material for this study is based on the one hundred and five consecutive operations in the service of Dr. George Ben Johnston since February 1905, when I became his first assistant.

A review of the current medical literature discloses several pertinent articles dealing with this question which would seem to show that this operation is still attended with a considerable death-rate. It is gratifying to note, however, that in most all of the large series of cases far better results are being obtained in the last two or three years, as compared with those of only few a years previously. This is no doubt largely due, as Deaver suggests (1), to an increase of experience in selecting suitable cases for operation, and to the added skill in the performance of the operation, together with the extensive employment of salt solution in hæmorrhage and shock. Of especial importance is operation early in the disease before degenerative changes have taken place in the fibroid growth as well as in the cardiovascular apparatus. The utter uselessness of all palliative treatment by drugs, electricity, etc., must be emphasized, as by such means the tumors only continue to enlarge until they become adherent to neighboring structures so as to entail most difficult and extensive dissection. The frequency of malignant degeneration is variously estimated, but a conservative average places this factor as about 2 to 4 per cent.

Hysterectomy for an uncomplicated fibroid is an operation that should be attended with absolutely no mortality, with the exception of the "unavoidable calamaties" (Maurice Richardson) due to anæsthesia, pulmonary embolism, etc. Such a statement can apply only to the work of an able and experienced operator and, as Noble remarks (2), the mortality in the hands of the occasional operator is as high as it was twenty years ago. After reviewing the results in his own cases, and adding to these the statistics of other experienced operators, Noble gives the following estimate of the mortality of operations for fibroid tumors: For supravaginal hysteromyomectomy in uncomplicated cases, 1 per cent; for the average cases as seen at present, from 2 to 4 per cent; in seriously complicated cases, 10, 20, or 30 per cent.

Under the caption, The Irreducible Minimum, Webster (3) calls attention to the recent published statistics from German clinics. The mortality from the operation of hysterectomy varied from 5 to 14 per cent, the average for the entire series of several hundred cases being about 8 per cent. He insists that such a mortality percentage is a discredit to modern surgery, and asks, if operators of recognized position furnish such statistics, what must be expected from the host of unskilled tyros who are practicing surgery in all civilized countries.

Deaver (1) in 1905 reported 219 supravaginal hysterectomies for fibroids with 20 deaths, a mortality of 9.13 per cent. In the last 105 cases, however, he lost only 3, giving a mortality of 2.85 per cent. Baldy (4) in the same year reported 250 operations with 21 deaths, a mortality of 8.4 per cent, while his 105 last cases showed only 3 deaths, or 2.85 per cent mortality. Werder (5) reports 118 operation by the abdominal route with only one death. C. P. Noble, in the first volume of his and Kelly's "Abdominal Surgery and Gynecology" p. 712, reports 88 supravaginal amputations (1902 to 1907) with no deaths, and quotes communications from Webster, giving 3 deaths in 100 operations, and from Kelly's clinic at Johns Hopkins Hospital giving an

[1] Read before the Tri-State Medical Society, Charlotte, N. C., February 19, 1908.

operative mortality of 3.1 per cent in 691 hysteromyomectomies.

In hysterectomy for fibroids the principal causes of operative mortality may be grouped as follows: 1. *The tumor itself:* complications due to large size, adhesions to organs outside the pelvis, degenerative changes, and twisted pedicle. 2. *Constitutional conditions:* severe anæmia and cardiovascular degeneration. 3. *Concomitant conditions:* complications due to inflammatory lesions of the adnexa, intraligamentary cysts, appendicitis, pregnancy, etc.

The operative mortality in hysterectomy for cancer of the uterus is always greater than in benign tumor growths. It is properly estimated at from 5 to 10 per cent, and this depends upon conditions both local and constitutional, which place this operation on a par with the more serious abdominal operations. Shock and hæmorrhage rank first as causes of operative mortality in the extensive operative procedures, while at the same time, certain conditions are present to favor the occurrence of such accidents as injury to the bowel, ureter, etc.

Other affections which may demand hysterectomy for their relief are extensive pelvic inflammatory disease, large intraligamentary cysts, pronounced uterine prolapse, etc. Here, again, the operative mortality is higher than in uncomplicated cases of fibroids, the chief factor being the more extensive dissection required, and the greater length of time consumed. The occurrence of active suppuration in the pelvis naturally predisposes to sepsis, while dense adhesions favor hæmorrhage and postoperative complications.

The question of technique and of the postoperative treatment will not be discussed, although they may figure most prominently in the success of the operation. The general principles involved are those of any intra-abdominal operation.

The cases which I wish to report include all the operations of hysterectomy performed by Dr. Johnston and myself from the first of February, 1905, to the first of February, 1908. During this period 105 hysterectomies have been done, with four deaths — a mortality of 3.8 per cent.

It is to be noted, however, that there has been no mortality in operations for uncomplicated fibroids, and it is furthermore of interest to note that in 1907 forty-three hysterectomies were done for all conditions without a death.

Before tabulating the full series of cases, I will make more definite mention of the four fatal cases. Case 1 was a large fibroid complicated with double pus tubes. The patient died on the seventh day from sepsis. Case 2 was an enormous fibroid that had undergone extensive cystic degeneration. It was adherent to the liver and diaphragm, with dense adhesions uniting it to the bowel and omentum. It could not be removed entire from a lengthy incision extending from just below the ensiform to the pubes. In addition, the patient had an organic mitral insufficiency. She died one hour after removal from the table. The operation was undertaken under the mistaken idea that the patient's symptoms were due to a very rapidly growing ovarian cyst. Case 3 was a palliative operation in a case of extensive carcinoma of the cervix which had already involved the vaginal wall. Patient died in 18 hours from shock. Case 4 was a woman with a cystic tumor of the left ovary and a large suppurating dermoid of the right ovary. After the pelvis was thoroughly cleaned out it was noted that the intestines, which had been packed off, showed on their peritoneal surface many superficial masses made up of gelatinous material similar to that contained in the dermoid. These were more or less flattened and varied in size from one-fourth of an inch to 4 inches in diameter. This case corresponds to the few similar cases which have been recently grouped under the name of malignant embryomata. Bland-Sutton (6) explains this condition by what he terms "epithelial injection," in which the contents of a dermoid escape into the belly, and the epithelial elements are not only engrafted on the peritoneum, but assume distinct malignant characteristics. The patient died four days after the operation.

TABLE OF 105 CONSECUTIVE HYSTERECTOMIES, FEBRUARY, 1905, TO FEBRUARY, 1908.

1. Operations for fibroids of the uterus. Total		
Hysterectomy	42	
Complete hysterectomy	18	60

2. Operations for cancer of cervix or body of uterus.		
Vaginal hysterectomy	3	
Complete hysterectomy	10	13
3. Operations upon cysts.		
Large intraligamentary cysts	5	
Double ovarian papillomata invading mesometrium, with peritoneal warts	3	
Malignant cystic disease of ovary	2	
Suppurating dermoid cysts	2	
Complete hysterectomy		12
4. Operations in pelvic inflammatory disease.		
Hysterectomy	4	
Complete hysterectomy	10	14
5. Operations for uterine prolapse		
Hysterectomy	5	5
6. Operation for associated pregnancy and fibroids.		
Hysterectomy (Porro's operation)	1	1

It would be most interesting to go fully into the history of these 105 operations but the main object of this communication would not be thereby augmented, and the short time at my disposal forbids such a digression.

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THE PATHOGENESIS OF GANGLIA

WITH A DESCRIPTION OF THE STRUCTURE AND DEVELOPMENT OF SYNOVIAL MEMBRANE [1]

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SO common an object as a "weeping sinew" or ganglion is of interest on account of the varous hypotheses of development consequent upon the obscurity of its cause and manner of growth. By ganglion is meant the small, sharply outlined, oval, firm, cystic tumor usually found on the dorsum of the wrist. Before considering the many hypotheses of the pathogenesis of ganglia held by the various authors, let us state the salient features of their clinical history, pathological anatomy, and the results of treatment.

CLINICAL HISTORY. Ganglia occur on the dorsal and palmar surfaces of the wrist and hand, and on the flexor, rarely on the extensor, surface of the fingers. They also occur on the dorsum of the foot and around the ankle. Cysts structurally similar to ganglia occuring in other parts of the body, for example, around the knee-joint, are occasionally called ganglia but are usually considered distended bursæ.

Ganglia of the wrist occur so frequently in individuals of slight build who are forced to use their hands vigorously, that it is an accepted fact that strain or injury is an etiological factor in the development of such carpal cysts. They usually exist as small, oval, tense tumors, which contain a clear, syrup-like fluid, and may develop slowly or rapidly upon a tendon which has been subjected to unusual strain or to more than ordinary exercise. (B. F. Curtis.)

PATHOLOGICAL ANATOMY. These cysts are closely related to tendon sheaths and capsules of joints. To exemplify them the following description from König is reviewed: "The anatomical examination of ganglia shows that they consist of a thin-walled connective tissue

[1] A Study from the Department of Surgery. Through the courtesy of Professor T. M. Prudden the work for this paper was done in the laboratory of the Department of Pathology, College of Physicians and Surgeons, Columbia University.

sac, which is lined by endothelial cells. In general there is a single sac; sometimes the sac is separated into two or more compartments. Occasionally, besides the main tumor, there exist a number of smaller ones which may or may not communicate directly with it. These swellings are never truly spherical but are usually ovoid. They are usually attached to the capsular ligament by their smaller end. This point of attachment varies more or less in extent. Not infrequently this attachment is prolonged into a pedicle which may be hollow except for a small septum, which closes off the tumor from the joint, or it may be a solid fibrous cord. This formation of the pedicle is most probably the effect of constant traction on the tumor, brought about by the motion of the hand. Frequently in the course of time, the pedicle apparently disappears. Thus one finds at typical situations, for example beneath the radical artery, completely isolated tumors which do not show any pedicle at all. They also may be adherent to the neighboring tendon sheaths, although the ganglia have not taken their origin from them. Under such circumstances the tendon sheaths are opened when the tumors are removed at operation."

If a ganglion, either with or without a pedicle, occurring on the back of the wrist, be dissected out after it has become separated from the joint capsule, the cyst may be found between or superficial to the extensor tendons; but any existing pedicle can be traced down to the neighborhood of the joint, where it is often lost. The contents of such cysts are at times a thin viscid fluid resembling synovia, occasionally thickened and gelatinous in character.

THE RESULTS OF TREATMENT. A ganglion, ruptured subcutaneously and then subjected to continued pressure, does not often reappear. If aspirated, the cyst usually refills promptly; but if the lining cells are destroyed by the injection of an irritant after aspiration, or by curetting after incision, the cavity may be obliterated by scar tissue.

I. THE VIEWS HELD REGARDING THE PATHOGENESIS OF GANGLIA.

The pathogenesis of ganglia has been of universal interest for many years. In reviewing what has been written on the subject, it is found that as early as 1746 Eller commenced the study of the problem, and concluded that the tendon sheath might tear and the synovia flow into the cellular tissue, thus forming the cysts under consideration.

König quotes Henle, who described, in the year 1846, small closed vesicles, some isolated, others connected like a bunch of grapes, which are filled with a glue-like substance and are usually observed on the deep synovial sheaths of the flexors and extensors of the fingers and toes. He looked upon them as the starting point of alveolar gelatinous tumors that form in the normal connective tissue spaces and increase with age, being distinguished from the serous cysts by the nature of the fluid they contain. (Perhaps these were tuberculous in origin, a distinction not being made at that period.)

Gosselin, in 1852, studied the subject very carefully. He condemns the hernial theory and advances four others as popular at his time in addition to his own. His theory is that in the subsynovial space there are many little white or gray bodies, which form slight projections into the joint. To expose them one must remove the synovial membrane. They do not usually communicate with the joint. One can compress them and still not empty them. If opened they discharge an oily, yellow or red material, similar to the contents of a ganglion. All synovial membranes, he states, especially those of the wrist, are provided with pockets and crypts. The obstruction of the crypts together with the accumulation of fluid is, to his mind, the origin of ganglia. He suggests that the small subsynovial bodies are developed from the crypts in the synovial membrane.

Volkmann thinks that ganglia are new growths in a restricted sense, formed from diverticula of the capsule, and are not necessarily herniæ.

Pick presented at a meeting of the Pathological Society, London, a preparation of a wrist removed at autopsy, showing two ganglia; one, the size of a bean, was under the radial artery; the other, somewhat larger, was on the dorsum of the wrist, among the extensor tendons. The dissection had been made to verify the observations of M. Chassaignac, who had stated that ganglia under the radial artery are usually prolongations of the synovial membrane of the wrist joint. Pick found that the ganglion under the radial artery had a prolongation of synovial membrane which communicated with the synovial sac, between the end of the radius and the scaphoid. The cyst on the dorsum of the wrist was found to have no communication with the interior of the joint.

Vogt classifies ganglia as developing from: 1. Tendon sheaths. 2. Joints. 3. Bursæ. He believes that a ganglion, when formed from the tendon sheath, may be produced by hernial protrusion, retention cyst formation, or hygroma of the synovial sheath.

Chaput lays stress on the folds of the synovial membrane and mentions the small cysts or bodies apparently corresponding to those of Gosselin and Henle.

Falkson has published thirteen cases of ganglia, in

which not a single one originated from the tendon sheaths; all sprang from the wrist, ten from the dorsal and three from the palmar surface. He lays down the rule that every ganglion is filled with a gelatinous material and that no cyst filled with anything else is a ganglion. He mentions one as multilocular. No epithelium or endothelial cells were found lining any of them. All the cysts described by him extended to the joint capsule, six with broad base, seven with pedicle, and most of them were adherent to the tendon sheaths. In eleven of the cases there was certainly no connection with the joint-cavity. Falkson thinks the adhesions to tendon sheaths were secondary. He rejects the hernial hypothesis and also the hypothesis of Volkmann and Virchow, that ganglia arise from tissue clefts.

Witzel describes a number of cysts of the sheaths of flexor tendons. He gives no microscopic description but mentions that one contained colloid material. He considers that they are herniæ of the tendon sheaths.

Ledderhose, in his first published article on ganglia (1889), described six cysts near the knee-joint. He believed that because of a mucous or colloid degeneration small cysts were developed in fibrous tissue and that by fusion a single or multilocular ganglion was formed. The statement is made that they were lined by endothelium. These cysts were found in relation to the periosteum of the tibia and Ledderhose believed the exciting cause to be direct trauma or injury to the tissue through twisting the knee.

In 1893, Ledderhose published his second article on ganglia, in which he pays particular attention to eight cysts occurring in relation to the wrist. All his described cases were similar to one another. The cells lining the cavities of the cysts were said to be in some places endothelial and in other places connective tissue, although he regards the cavities as formed by degeneration. In certain ganglia there were a number of small cysts in the walls of the main cavity. The contents of the ganglia varied from thin fluid to very thick colloid material. Ledderhose was positive that the majority of the ganglia did not communicate with the joint-cavity and that they do not unless the thin septum between the ganglion and joint-cavity is ruptured. Therefore, if at the time of operation such communication is found, the theory of cystic degeneration is not necessarily overthrown. He concludes from these eight cases that the cysts are all about the same in structure, differing only in minor details, due to the degree of "ripeness." He discards the hypothesis of hernia of joint and tendon sheath and also Gosselin's theory, and says that ganglia are new growths developed by degeneration, not only in the periarticular structures but also at a distance from joints, and owe their origin to frequent slight traumata, for example, the repeated flexion and extension made by piano players. Ledderhose includes in the article a drawing of a multilocular cyst, in which the walls of the cavity are irregular and undergoing degeneration.

Thorn examined seven cases. He, as well as Ledderhose, reached the conclusion that ganglia are caused by degenerative processes and occur chiefly in periarticular structures, excited by repeated traumata. To eliminate the possibility of bacterial infection as a cause of the degeneration, Thorn tried animal inoculation with ganglia contents and obtained a negative result. He states that in ganglia the lining wall of the main cyst may be composed of well-formed connective tissue, showing by its structure a reparative process, while degenerating spots are found farther out in the tissues. The contents of the cysts are made up of the detritus of broken cells, intercellular substance, and serous effusion. The large cells in this material are undergoing mucinous changes. An obliterating endarteritis existed because of an overgrowth of the intima, and he holds this in a causal relation to ganglia. Thorn also claims that ganglia do not communicate with joint-cavities unless they happen to break into them. He denies that ganglia are ever lined with endothelium and thinks that, if Ledderhose maintains that they are caused by degenerative processes, Leddderhose cannot claim that they are lined with endothelium, or else, as he states, the word endothelium signifies to him something different from its accepted meaning. One of his cases is of considerable interest. A cyst, 1 cm. long, occurred in the actual tendon tissue of that part of the extensor communis digitorum which supplies the index finger. Microscopic examination showed that the cyst was apparently produced by colloid degeneration of the tendon tissue.

Ritschl has described a multilocular cystic tumor resting on the capsule of the knee-joint. It contained a jelly-like material and its walls were connective tissue. He decides that it was similar to a ganglion and was formed by connective tissue degeneration, preceded by, or simultaneous with, changes in the blood-vessel walls.

Franz has described seven ganglia, occuring in relation to the flexor tendon sheaths of the fingers. In one of these cases, the patient had wounded the flexor tendon sheath of his finger three months previous to the development of the ganglion. At operation a small tumor was found in the substance of the tendon itself. Microscopic examination showed that two cysts had actually developed, produced by mucinous degeneration of the tissues. In four of his seven cases there was no connection with the adjacent synovial cavity. In the other three cases this fact could not be proven. In two specimens the hæmatoxylin stain indicated that mucin made up the cyst contents. There was no sclerosis in the vessels, although there was a perivascular thickening. He believes that the ganglia were all preceded by trauma which provoked mucoid degeneration. His results in general agree, he thinks, with those of Thorn, Ritschl, Payr, Ledderhose, and Borchardt, and the subsynovial corpuscles of Gosselin, Teichmann, and Michon are similar to his own specimens. In his article a number of cuts are presented, showing in one large swollen cells entangled in the amorphous mocoid mass filling the cyst; and in another, lining cells resembling endothelium.

Borchardt described minutely a ganglion, as he calls it, occurring in the tendon of the long head of the triceps brachialis, and claims that his findings are similar to those of Ledderhose, Thorn, and Payr. Clinically

it was thought to be a neuroma. At operation, a cyst, measuring 8 x .5 cm., containing colloid material, was found developed in the shining substance of the tendon. The cyst on microscopic examination was found to contain a granular amorphous mass, which showed a great affinity for hæmatoxylin, similar to the action of mucin. This mass contained a vast number of globular cells with vesicular nuclei. The protoplasm of these cells contained vacuoles. The connective tissue cells, lining the wall of the cyst, were undergoing hydropic degeneration. The capsule of the cyst wall had the general characteristics and form of normal tendon tissue. In this wall was found a secondary cyst, with lining and contents similar to the main cyst. There was no history of direct trauma. Borchardt thinks that the occupation of the patient, a dentist, had produced an inflammatory condition in the tendon. No extensive arteriosclerosis was present and he agrees with Payr that such a process may be secondary and not contributory to the formation of such cysts. Borchardt considers his ganglion of interest since it occurred in the tendon of a muscle at a distance from the synovial membrane of a joint or tendon sheath. He mentions the fact that only two similar cases have been published, those of Thorn and Hofmann. Reidinger's case of albuminous periostitis, the cysts near the knee-joint described by Ledderhose, and the cyst of Falkson, he believes were similar to ganglia. Three drawings are exhibited by Borchardt, illustrating his cyst. One of these demonstrates the cells in the cyst itself; another shows the vacuolation in the protoplasm of the individual cells.

Jordan has reported twenty-five consecutive cases of ganglia, the majority occurring on the dorsum of the wrist, which were treated by aspiration followed by an immediate injection of Morton's fluid (iodine, potassium iodide, and glycerine). In none of them were any signs of acute inflammation of the wrist joint or tendon sheaths noted, which would be expected if there were communication between the respective ganglion and the above synovial spaces.

Féré has observed a special disposition in certain families which he calls "diathèse kystique."

Morestin described a unilocular cyst, containing a thick rosy colored fluid, attached to the tendon of the semimembranosis where it passed into the muscle belly. No microscopic examination was reported.

Frederick discusses the pathogenesis of ganglia and concludes that a ganglion is a "cystoma" resulting from colloid degeneration of the connective tissue. When several areas of degeneration exist, the ganglia formed are multilocular; the septa between the various compartments disappear gradually and form the unilocular ganglion. He quoted Maissonneuve, Verneuil, and Witzel, as having reported small hard cysts, lined by endothelium, attached to the capsule or the periosteum and situated upon the flexors in the palm, in the metacarpophalangeal joint, or upon the flexor surface of the phalanges, causing neuralgia in the nerves of the fingers by their pressure.

König, in one edition of his work, makes some interesting comments. In discussing the lining cells, he says: "Ganglia are shown to be made up of connective tissue, lined with endothelium. The latter is difficult to demonstrate by ordinary silver nitrate stain because the gelatinous contents are so firmly adherent to the cyst wall that the silver solution does not come into direct contact with the lining endothelium. Yet in properly stained specimens this endothelial lining can easily be made out." He speaks of the idea of calling the tumors, which have sprung from the subsynovial corpuscles or bodies, "synovial dermoids." "If one wishes to do so there is nothing against it. As a fact, however, the term 'dermoid' has not up to the present time been extended to the synovial endothelium." In a later edition he concludes: "Recently many ganglia have been extirpated but we have not advanced in the discovery of their origin, because further anatomical researches are wanting, especially upon the wrist joint. We would have to suppose that here many diverticula existed, yet diverticula about the knee- or elbow-joint are more frequently mentioned, although ganglia are very rarely found in these situations. This is a circumstance which points against the development of ganglia from hernia."

Payr, of Gratz, as recently as 1898, wrote the most comprehensive article yet published on the subject of ganglia and described thirteen cases. He has determined that ganglia in general occur between the twelfth and the twentieth years. Almost invariably the individuals are small, delicately built females, who have not been exposed to hard work or excessive trauma. Their occupation has been fancy work or light household labor. Payr does not believe that ganglia are caused alone by direct blows and violent overstraining, or their occurrence in men would be more frequent. He says, "We must therefore add other circumstances which as yet are not perfectly understood, in order to explain the appearance of carpal ganglia." He found very few ganglia in old people; even in a large hospital service none was found at autopsy. Payr states this because Falkson has attempted to explain why such a large number of young people apply for treatment, by suggesting that they do so through vanity, while old people ignore ganglia.

In his ganglia Payr found no free communication with the joint, contrary to both Volkmann's and König's statements. He mentions that Ledderhose considers the fat found infiltrating the connective tissue structures, to be a matrix which may be changed into a gelatinous mass by overstraining.

After studying the anatomy of the wrist-joint, Payr states that there is great variation in the tissue layer immediately surrounding the carpal bones. The wrist-joint capsule on the palmar surface is short and resistant, while on the dorsal it is longer and more relaxed. It is commented upon by Payr, that at this situation Hildebrand, in 1893, described a ganglion due to the hernial protrusion of the capsule. Payr, after careful anatomical examination of the wrist-joint, agrees with Ledderhose that the cause of ganglia must be sought in the periarticular tissues and the joint capsule itself.

The physical properties of the contents of carpal

ganglia are considered by Payr. Chemical agents, such as water, alcohol, acetic and chromic acid, gave varying results. Certain ganglia contents seemed to contain mucin, others pseudomucin, as found by Pfannenstiel in ovarian cysts. Payr does not determine whether he is dealing with mucus, mucin, hyalin or colloid degeneration.

Morphologically, a great variety of cells in an amorphous mass was noted in the ganglia contents. Giant cells, containing detritus and small drops of fat, large swollen cells from the lining capsule, lymphendothelial cells, and many other forms, especially a form containing large vacuoles in the protoplasm, are shown in a cut. Iodine seemed to indicate that these cells contained glycogen. Osmic acid demonstrated numerous drops of fat, both in and around the cells.

In speaking of the arteriosclerosis, considered important by others, Payr could not determine the causal connection between vessel changes and ganglia development. In fact, he believes that the vessel changes may be secondary to ganglia development. Commenting on the endothelial lining in ganglia found by others, he states that certain ganglia are lined by thin flat cells, obviously flattened connective tissue cells, which closely resemble endothelium, and that there are areas covered by cells that may actually be endothelial in character.

The article by Payr is closed with this statement: "Our view of the matter is that the joint capsule in this place is under certain circumstances a 'locus minoris resistentiæ', in predisposed individuals. Under the influence of repeated small injuries of daily life, changes occur in the capsule and the periarticular tissue about this site."

Riedel believes that ganglia develop in the substance of the capsule of joints and that they are usually attached by a pedicle which is closed by a septum. If this pedicle is divided at the time of operation, gelatinous material runs out of the ganglion and synovia out of the joint.

Lexer states that ganglia of the tendon sheath are rarely found. They have the same structure but are usually smaller than ganglia of the joint capsule and are thought to be due to cystic changes in the joint capsule. Out of 720 ganglia on the foot and hand, observed in the Poliklinic of Berlin, 102 afforded an opportunity for a future examination. Of 52 cysts, treated by subcutaneous rupture, 23 recurred, while those dissected out did not recur in 31 cases examined. In an additional case a new ganglion developed at a distance from the original site. Eight ganglia had disappeared spontaneously, ten through the use of a pressure bandage.

Höftmann, in 1876, was apparently the first person to speak of ganglia as synovial dermoids.

Gruber describes as a ganglion on the dorsum of the scapula, a hernia or prolongation from the shoulder joint of the synovial membrane, which had become a multilocular retention cyst containing thickened synovia.

Foucher observed a cyst on the great toe, connected by a pedicle of connective tissue to the synovial membrane of the metatarsophalangeal joint.

Hofmann has described a patient, seventeen years of age, who received a severe blow a year previous to the development of a cyst in the tissue substance of the tendon of the peroneus tertius, opposite the base of the fifth metatarsal bone. A fusiform cyst, containing a colorless, tenacious mass, was found at operation. The cyst wall was neither undergoing degeneration nor was it lined with endothelium. Hofmann believes that this ganglion, as he calls it, was due directly to trauma.

Beadles reports a patient with a prepatellar bursitis, who also had a row of four small cysts in the deep fascia of the dorsum of the left forearm and three in a similar situation in the right forearm. They were thick-walled and contained a clear fluid. Beadles believes that they were false bursæ caused by the man's occupation as a sailor.

Morian describes, occurring in a boy, a protrusion which resembled mother of pearl, containing colloid, in the fasicles of connective tissue surrounding the extensor tendon of the index finger, due, he thinks, to his occupation, lamp-lighting.

Tixier, Deutschlander, and Schlange have described thin-walled cysts containing fluid similar to synovia occurring either in the periosteum or in the bones themselves.

Codman has reported a thin-walled cyst, containing a straw-colored fluid, which occurred in the distal phalanx of a finger. This cyst was thought to be due to degeneration of either a chondroma or a blood-clot, caused by trauma.

Reidinger describes a cyst in an old man, situated in the periosteum over the tibia. Having aspirated it, he gives the chemical analysis of the contents. The fluid returning, he repeated the analysis, obtaining the same reaction as with his first specimen. Following aspiration, the cyst refilled a third time within ten days. The author considers the affection similar to a ganglion of the tendon sheath. He says that the contents of one of these which he had examined were the same microscopically and chemically as the contents of the cyst over the tibia. He claims that under certain circumstances the periosteum can secrete the same material as the tendon sheath.

Tillmanns states that Poncet and Ollier were the first to describe a peculiar form of periostitis under the name of periostitis albuminosa, "ganglion periostale," concerning the nature of which different authors hold very divergent views. "There will be found at the diseased point either a bloody serous, a hydrocele- or synovial-like fluid which has the consistency of tenacious mucus. The fluid lies either beneath the periosteum, or on its outer surface, or within it in the form of a cyst." Tillmanns says that in his opinion the disease is at the outset an acute or subacute nonsuppurative, nonserous osteomyelitis and periostitis, which is not a disease sui generis, but is caused by various factors, particularly by attenuated pus cocci (staphylococci); in some cases it may be of tubercular or syphilitic nature.

II. THE HPYOTHESES OF THE PATHOGENESIS OF GANGLIA.

It is apparent that for many years there was great diversity of opinion in regard to the cause of ganglia. Rapidly summarizing all hypotheses, it is found that they may in a manner be grouped together.

It was customary to regard such cysts as herniæ of the synovial membrane of a joint or tendon sheath through its capsule or fibrous sheath. Jordan has graphically described the condition as he believes it to exist, stating that a ganglion is a sudden extrusion of the synovial membrane through a chink in the capsule of a joint or sheath of a tendon. Later a plastic inflammation closes the outlet.

It was also thought that ganglia were formed from fœtal sequestrations of synovial membranes, similar to the fœtal inclusions of dermis forming dermoids.

In addition some investigators believe that certain folds and crypts, occurring in synovial membranes lining joints and tendon sheaths, are of such a character that pockets of unobliterated synovial membrane may be occluded by inflammatory adhesions in the outlet of the crypts and folds leading to the synovial cavity. When all communication with the joint or tendon sheath cavity has been shut off, the occluded synovial membrane continuing to secrete, a cyst is formed away from the joint or tendon sheath cavity.

Later, many observers claimed that ganglia were developed by cystic degeneration in the actual connective tissue structure of the capsules of joints and sheaths of tendons.

The writer suggests, with Vogt, that many of the cysts described as ganglia in connection with joints and tendon sheaths, may be regularly described anatomical bursæ distended because of simple serous inflammation.

Considering the merits of the above hypotheses, it is seen that the hernial explanation was accepted,— 1. Since it easily accounted for a cyst lined apparently by synovial membrane and containing fluid possessing the color and physical properties of synovia; 2. Since ganglia occasionally disappear for a time and suddenly recur, simulating closely the action of a hernial sac; and, 3. Since they are commonly supposed to occur only in the immediate vicinity of a synovial membrane. The objections to the hernial explanation are, that even in very recent cases an actual neck or protrusion of synovial membrane through sheath or capsule is not found; that in the majority of cases ganglia do not communicate with joint or tendon sheath cavity, being separated even in recent cases by a septum or solid wall of connective tissue from such cavities; that they can not usually be emptied or reduced by direct pressure; that they are frequently multilocular; that very similar conditions are found at points distant from synovial membranes; and also that they do not occur during an acute arthritis, when presumably the intra-articular tension is increased. The disappearance of a ganglion on pressure may be explained, as pointed out by Ledderhose and Thorn, by the fact that a ganglion would collapse if the thin separation, occasionally found between such cysts and the joint-cavity, should rupture. Later adhesions closing the torn septum would allow a recurrence of the tumor. The rupturing of this septum explains how occasionally at operation a probe may be passed through an opening in the ganglion directly into the joint-cavity.

The second hypothesis, that ganglia are formed as dermoids, is certainly untenable when the fœtal development of synovial membranes is considered, as will be mentioned later. This development is not analogous to the growth of the epithelial covering of the body. In the latter case there is a building up from active epithelial cells and these cells will continue to proliferate wherever placed; whereas in the development of joints, tendon sheaths or bursæ, there is no acquisition of tissue but on the contrary a loss of tissue occurs, that is, the mesodermal cells are sacrificed at the site of the synovial cavity. The connective tissue cells, which happen to be on the edge of this forming synovial cavity, are differentiated and altered by pressure or other causes into the specialized cells of synovial membranes. In other words, if it were possible to displace these connective tissue cells which are destined to line synovial membranes, they would not necessarily become synovia-producing cells; and if cells already differentiated were displaced, the above being a

proper interpretation of joint or bursæ development, lacking the specializing factor, they would not of necessity produce additional synovial cells. I do not deny in the above that the factor, which ontogenetically calls forth anatomical synovial cavities, may not also call forth unusual or adventitious synovial cavities, but this is not a growth from displaced cells as considered above.

The third hypothesis, that synovial retention cysts form ganglia, is very similar to the two hypotheses, that ganglia develop by hernial protrusion or by fœtal sequestration. This third hypothesis is certainly much more acceptable than any yet advanced, since such a cyst would not, because of the adhesions necessary for its development, have any such connecting neck as a real hernia should have. Also the objection made to the hypothesis of fœtal sequestration namely, that a cyst is developed from cells not as yet differentiated into synovial cells, does not obtain, because we presuppose the closing off of a portion of a completely developed synovial membrane.

It may be noted that the three hypotheses given above depend upon the development of a ganglion from synovial membrane, which in the early stages was within the capsule of the joint or the sheath of the tendon and, in some manner, passed through such capsule or tendon sheath during its development. The two remaining hypotheses, one that ganglia are anatomical or regularly described bursæ distended because of simple serous inflammation, the other that they develop by cystic degeneration of the joint capsule or tendon sheath, presuppose that the starting point is outside and superficial to the joint capsule or tendon sheath.

In addition to the possibility that certain ganglia are, as already mentioned, hydrops of anatomical bursæ, there is the possibility that adventitious bursæ may be developed and later become distended. Accidental or adventitious bursæ, containing fluid physically similar to synovia, occur in parts of the body where anatomical or regularly described bursæ are never found, provided the proper irritation or trauma is supplied. Such bursæ occur in connective tissue layers over the ends of bones in amputation stumps and also in connective tissue in various situations, as on the backs of peddlers who carry packs; one such bursa, described later, occurred on the end of a hammer-toe beneath a corn. Tillmanns states: "Bursæ as a rule, develop in places where the skin, fascia, muscles, etc., are subjected to continual pressure and friction, particularly over bony prominences. This explains why the number of bursæ is not constant, and why bursæ form in portions of the body other than where they normally occur (so-called accidental or supernumerary bursæ.) Young children lack a large number of anatomical bursæ which subsequently develop as the parts become subjected to increased use. The number of the more or less constant bursæ is very great. Gruber found eighteen in the parts around the knee-joint and eleven at the elbow, Velpeau found fourteen bursæ on the dorsum of the hand."

In regard to the last hypothesis, that ganglia are formed by cystic degeneration, it is at once seen that the etiological factor which determines the development of the above-mentioned adventitious bursæ is not at all the etiological factor which determines the cystic degeneration mentioned by Ledderhose, Thorn, Borchardt, and others. It is true that they mention trauma as an excitant, and in a way the constant irritation which finally produces an adventitious bursa is trauma; but not in the sense that Ledderhose and others indicated as the exciting cause of ganglia. The development of an adventitious bursa takes place through a physiological metamorphosis in the tissue cells to meet the requirements of the body, similar to the development of an anatomical bursa. Since the arteriosclerosis taking place in the vessels is mentioned by the above authors, all of them, except Borchardt and Payr, evidently consider the lesion one of poor nourishment, similar to the cystic degeneration occuring in fibroids apparantly due to diminished blood supply.

If, therefore, we accept the vast amount of evidence advanced by the students of ganglia to explain their presence, the hernial hypothesis is in the majority of cases disproved; that ganglia are similar in development to dermoids is untenable; that they are obstructed crypts or pockets of synovial membranes is possible. The remaining hypotheses are probable,

namely, that certain of them are hydrops of bursæ, both anatomical and adventitious, and that the majority are caused by cystic degeneration of connective tissue.

In an attempt to reach the truth, the findings of the various writers may be reviewed; the lining cells of ganglia may be studied morphologically and microchemically, and compared to synovial membranes; ganglia contents may be examined microchemically and compared to synovia; and the development of synovial membranes may be investigated and studied.

To explain the occurrence of ganglia, a number of them from the wrist, also a cyst from the knee, have been studied, both in gross and in microscopic sections. Two small cysts from the flexor tendon sheath of the hand are described in detail. The lining cells and general structure of ganglia have been studied and an attempt has been made to impregnate the intercellular cement substance of synovial membranes and the lining of ganglia with various silver salts, in order to define the cell outline, that the cellular lining of ganglia and synovial membranes may be compared morphologically. The presence or absence of endothelium, as already noted, must necessarily be determined both on synovial membranes and in the lining of ganglia, in order that some definite conclusions may be arrived at as to the pathogenesis of ganglia. I have used protargol to impregnate the intercellular or ground substance, and hæmatoxylin and eosin as a contrast stain. Protargol has been suggested because of its penetrating qualities, by Cl. Regaud and L. Dubreuil (referred to by Schiefferdecker) as useful in the study of the peritoneum and pleura to define pavement or endothelial cells. Other tests have been used on the lining cells of both ganglia and synovial membranes to determine if possible any resemblance or difference.

The development of joints and tendon sheaths has been observed in sections, the opinions of authorities on such subjects have been reviewed, and, as König advises, the normal anatomy of joints and tendon sheaths at various ages has been investigated. The cellular lining from two knee-joints in a condition of chronic synovitis is described, to demonstrate pathological synovial membrane; also the cellular linings of an adventitious and an anatomical bursa are compared morphologically.

III. CASES AND SPECIAL INVESTIGATIONS.

A typical ganglion from the dorsum of the wrist is first presented for examination.

Case 1. In March, 1906, a girl, 20 years of age, applied at Vanderbilt Clinic because of a smooth, oval, elastic, painless swelling on the dorsum of her right wrist. The tumor had first appeared about four years before and had grown very rapidly. During the first two years the cyst was aspirated six or seven times, but refilled within two weeks after each aspiration. The patient described the fluid as clear and sticky. During the last two years she had had no treatment of any kind.

Operation. Cocaine anæsthesia; Dr. J. I. Russell. A longitudinal incision was made over the tumor, which was situated between the sheath of the extensor longus pollicis and that of the extensor communis digitorum. The cyst tapered off and was attached by a pedicle to the capsule of the wrist joint. After removal an examination revealed no opening into the joint-cavity. The wound healed by primary union.

Gross Examination. The specimen was a thin-walled sac, measuring 15 x 10 mm., with an opening at one end, out of which a clear, thin, viscid, straw-colored fluid oozed. This fluid was removed by irrigation with water and a partition was found dividing the sac into two parts. The walls were so thin as to be translucent. The second cavity was also emptied by irrigation and small sections of the lining membrane were detached and impregnated in the dark for varying lengths of time, with a 1 per cent solution of nitrate of silver. To be certain of impregnating some one specimen the proper length of time, some sections were left in for two hours, while others were left in the silver solution for a much longer time. The sections were exposed on a slide to the sunlight, with the surface lining the cyst uppermost, and were observed with the microscope from time to time, to discover if possible any cells of an endothelial nature. The result in each case was negative. The remainder of the specimen was fixed in Orth's fluid and sections were cut to include the capsule and the partition which divided the cyst.

Microscopic Examination. Hæmatoxylin and eosin stain was used. The main wall of the sac was dense fibrous connective tissue. The long, slender, fusiform cells were in parallel rows and the cell bodies did not stain readily. The wall of the small cyst was made up of the same type of cells, smaller in size. The lining cells were apparently connective tissue and were similar in morphology to the cells lining synovial membranes. No signs of degeneration could be found in the cells of any sections. The vessels seemed to be normal in number, and showed no sclerosis. Adhering to the wall of the cyst was a thin, deeply stained, blue layer, apparently the remains of the ganglion contents.

A cyst removed from near the knee-joint is next described. It is of interest because it is

multilocular and its general appearance is similar to that of a ganglion from the wrist.

CASE 2. An adult male presented himself at the Roosevelt Hospital, April 28, 1906, because of a swelling on the inner side of the right knee, just over the joint. It had been noticed by the patient for seven months.

Operation. Ether anæsthesia; Dr. J. A. Blake. An incision over the tumor revealed a multilocular, thin-walled cyst, presenting between the tendons of the sartorius and semitendinosus. At one point it was adherent to the capsule of the knee-joint and extended from that point outward. At the time of removal, some thick, clear, jelly-like fluid escaped from either the joint or one of the cavities of the cyst.

Gross Examination. Tumor measured 14 x 8 mm. There were three separate compartments intact, with an additional one partially collapsed. The walls of each compartment were firm and strongly built. A smear of the viscid contents of the cyst showed microscopically a vast number of large oval cells, together with a mass of crystals.

Microscopic Examination. A section of the lining wall was detached and an effort was made to impregnate the intercellular substance with protargol; the result was negative as far as endothelium was concerned. The balance of the specimen was prepared in the regular way. Cut sections showed a rather dense connective tissue framework, with no characteristic cells lining the cysts. Each cavity was filled with a coagulated mass. There were no distinguishable features between the connective tissue partitions and the retaining walls of the cyst proper.

The microscopic structure of the two specimens already described was alike. These specimens were lined with connective tissue cells. It was not possible to demonstrate with silver salts any endothelial cells lining either cyst. Both cysts, it will be noted, were of long standing and, as Ledderhose suggests, they were so far developed that no active process, as represented by degenerating cells, could be found.

The next cases presented are two cysts from the flexor tendon sheath of the fingers, similar to types mentioned by Henle in 1846, later by Witzel, and recently by Franz.

CASE 3. In 1904, a young girl presented herself at the Out-Patient Department of the Roosevelt Hospital, complaining of a tender area on the flexor surface of the base of the proximal phalanx of the index finger of the right hand. This tenderness had been present about three months and was noticed when any solid object was grasped. On examination a small, firm nodule was found in the deeper parts of the above region.

Operation. Ether anæsthesia; Dr. C. P. Flint. A small, longitudinal incision over the site of the tumor revealed a cyst in the substance of the flexor tendon sheath. A portion of the tendon sheath including the cyst was removed, opening the synovial cavity. The tendon itself appeared smooth and glistening and was unattached to the cyst. The sheath was closed with one catgut suture and the soft parts above were approximated. The patient later was discharged cured.

Gross Examination. The cyst was oval, smooth, sharply circumscribed, and situated in the substance of the sheath. It measured 2 x 3 mm. and was very elastic and also translucent because of its thin walls and clear fluid contents. It resembled a pearl-like vesicle, implanted in the connective tissue of the sheath. The specimen was placed, unruptured, in Orth's fluid. The second day after immersion in the fixative, the cyst was divided into two parts, parallel with the long axis of the tumor. The contents at this time had coagulated. The growth divided the tendon sheath in such a manner that the fibers of the sheath passed both above and below it. The presence of the tumor was not indicated in any way on the synovial surface of the sheath, the growth extending only in the direction away from the synovial cavity.

Microscopic Examination. Many sections were cut through tendon sheath and ganglion parallel with the long axis of both cyst and tendon (Drawing No. 1). Sections were stained with hæmatoxylin and eosin. The tendon sheath itself, in every section cut, was intact below the cyst and consisted of very dense parallel connective tissue fibers.

The main cyst or ganglion is shown in Drawing No. 1, B. The outer layers of connective tissue, surrounding the cavity, were dense and homogeneous, similar to the structure of a tendon sheath. The middle portion of the cyst wall was more cellular and the individual cells were shorter and broader (Drawing No. 2, B). The innermost cells were swollen, vesicular, and transparent. Marked vacuolation existed in the protoplasm of the cell body, because of the degeneration that had taken place. A few of the cells were ruptured and the nuclei were free (Drawing No. 2,E,E). These cells were held in place by the coagulated material which filled the cavity of the cyst, supposedly products of cell-degeneration. In the more superficial layers of the sheath substance, in addition to the main cyst itself, were many small, oval openings (Drawing No. 1, A, A, A, A). The cells, lining these cavities, showed no degeneration. These spaces were probably due to fat infiltration. There were also two small areas, not actually cysts, outlined by degenerating cells (Drawing No. 1,C). A thin homogeneous mass, similar to the coagulated material described in the main cyst B, occupied these areas. In the entire specimen the blood-vessels seemed to be normal in number and showed no signs of sclerosis.

The fusing of the main cyst with the two smaller areas exemplifies the formation of ganglia by cystic degeneration and also shows, when a septum persists between two such degenerating areas, how ganglia may be multilocular.

Case 4. In June, 1906, an adult colored woman presented herself at the Out-Patient Department of the Roosevelt Hospital because of a small tender tumor of two months' duration on the flexor surface of the base of the proximal phalanx, ring finger, left hand. On examination a small, firm, rather tender cyst was palpable in the above region.

Operation. Cocaine anæsthesia; Dr. W. Darrach. A small longitudinal incision over the tumor allowed it to be easily removed intact, with a portion of the tendon sheath. After the cyst was removed there still remained a certain amount of the tendon sheath closing the synovial cavity. The small skin wound was closed with two sutures and the patient was discharged in a few days cured.

Gross Examination. The specimen was a small, smooth, oval cyst in the substance of the tendon sheath. It measured 3 x 4 mm. After preparing it, sections were cut and stained with hæmatoxylin and eosin.

Microscopic Examination. The general arrangement of the cyst and sheath of tendon was similar to that of Case 3, except that in the present case the cyst was partially divided by a septum. A mass of coagulated material filled the cavity and entangled in this substance were a number of large oval cells. The walls of this cyst as well as the septum were dense connective tissue. No degenerating cells existed, unless the free cells noted above could be so classed (Drawing No. 3).

Cases 3 and 4 are of interest since they prove emphatically the occurrence of cysts in connective tissue structures absolutely without connection at time of operation with any synovial cavities. Case 3 illustrates a cyst in connective tissue, lined by cells undergoing degeneration.

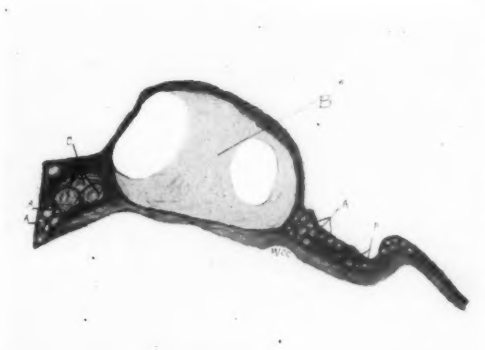

Fig. 1. Case 3. Longitudinal section from flexor tendon sheath of the index finger, showing a degeneration cyst *B* or so-called ganglion in its substance. Preparation: hæmatoxylin and eosin.

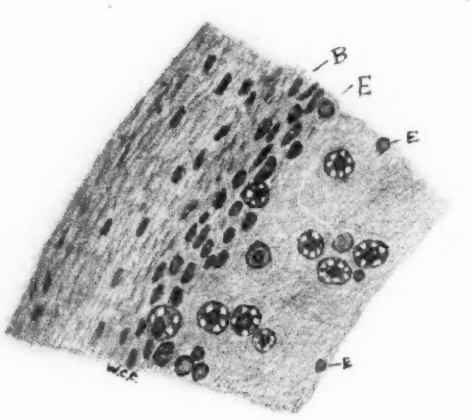

Fig. 2. Case 3. Cross section from wall of degeneration cyst. This shows the cells lining the cyst in various phases of degeneration. Certain of these cells are free in the cyst contents. Preparation: hæmatoxylin and eosin.

The following case is of great interest, since the cyst occurred in such close relation to the tendon itself, that it could not be by any chance a hernial protrusion or obstructed pocket of the synovial membrane. This cyst resembles more closely than any other of my cases that of Thorn's, which occurred in relation to the extensor tendon of the index finger.

Case 5. A woman, 45 years of age, applied at the Vanderbilt Clinic, March 7, 1907, because of a swelling on the dorsum of the right hand, over the proximal end of the fourth metacarpal bone. She stated that she had not been conscious of having injured herself in any way, and had only noticed the tumor for two weeks. On examination, a smooth, sharply circumscribed, elastic swelling was noted in the above region. This swelling made an excursion up and down the dorsum of the hand, simultaneously with flexion and extension of the ring finger.

Operation. Cocaine anæsthesia; Dr. F. E. van Beuren. A longtitudinal incision over the tumor exposed the superficial layer of the synovial bursa, which incloses the extensor tendons of the fingers. On opening this bursa the extensor tendons were exposed, also a smooth, oval, glistening, pearl-like, sessile cyst attached to the ulnar side of the extensor tendon of the ring finger. This cyst was covered by the visceral layer of the synovial membrane and protruded into the synovial cavity. It was easily dissected from the tendon to which it was attached.

Gross Examination. The cyst measured 7 x 12 mm. It was oval, with a slight constriction about its middle, and on one side a ring of connective tissue remained where the cyst had been removed from the tendon.

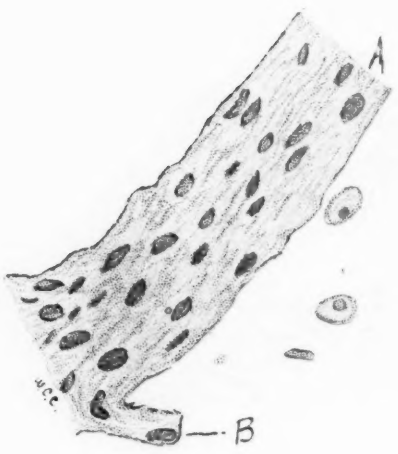

Fig. 3. Case 4. Cross section of wall of the ganglion *A*. Cells are few in number and are supported in a fibrous connective tissue framework. A section of septum is also shown *B*. Preparation: hæmatoxylin and eosin.

The walls of the cyst were thin and translucent, the contents gelatinous and clear. Microscopic examination of an evaporated smear of the contained material, stained with carbolic fuchsin, revealed no microorganisms. The specimen was fixed in 80 per cent alcohol and transverse sections were cut to show the cyst wall and also the base where it had been attached to the tendon.

Microscopic Examination. The cyst wall was made up of dense layers of fibrillated connective tissue. At one or two points the lining cells were swollen and œdematous, but elsewhere were compressed connective tissue cells. The external surface of the cyst, which had been covered by a synovial membrane, was made up of flattened connective tissue cells. In the center of the wall there were several spaces in which the cells were swollen and œdematous and separated from one another by products of degeneration. In the widest part of these spaces, the material was found slightly granular, staining a faint blue with hæmatoxylin. The vessels in the wall of this cyst were patent and looked normal. The ring of connective tissue, attaching the ganglion to the tendon, was loosely built and showed no peculiarities.

In addition to the ganglia examined above, a number of others were obtained and attempts were made to define the outlines of the lining cells by means of protargol, to determine the presence or absence of endothelium. The nearest approach to success is demonstrated in the following case.

CASE 6. A mechanic applied on March 26, 1906, at the Roosevelt Out-Patient Department, on account of a swelling on the dorsum of the right wrist, which had been present three months.

Operation. Cocaine anæsthesia; Dr. Karl Connell. Incision exposed a cyst on the ulnar side of the extensor tendons of the wrist, just opposite the styloid process of the ulna. The tumor was free, not connected with the joint capsule or tendon sheath.

Pathological Examination. The technique already referred to was used to demonstrate lining cells by means of protargol. The mass of tissue was prepared and sections were cut parallel with or tangential to the general free surface, so that, owing to the small depressions and elevations inevitable in any membrane, islands and thin sections of the actual surface cells were obtained. These sections were stained with hæmatoxylin and eosin. Thus the part of the section impregnated with a precipitate of protargol was that which, before cutting, had been free surface tissue, while the entire section was stained with hæmatoxylin and eosin.

Microscopic Examination. Tangential section. Low power. The margin of the section or part which alone had been exposed to the protargol was distinctly marked and dark brown. This margin varied in width, dependent on the slope of the free surface when the section was cut.

High Power. There was seen a distinct network of coarse lines of silver granules, through the meshes of which the cell nuclei appeared. In addition to this network of coarse lines, there was also an incomplete network of fine lines. The majority of the coarse lines were on the free surface of the tissue, while most of the fine lines were beneath the free surface.

Cross Section. Low Power. Sections, cut at right angles to the plane of the tangential sections, exhibited the same sharply marked, brown margin described above, wherever the free surface impregnated with protargol was divided. The topography of the free edge of this brown margin proved that the membrane was made up of a series of small hillocks between which were dark spots, cross sections of the coarse silver lines already noted. Many fragmentary lines of fine granules, surrounded by a scanty precipitate, projected a short distance into the tissue away from the edge.

I believe that the granular or hillock-like condition of the surface described above was caused by fixing the tissue in too strong alcohol, which contracted and wrinkled the surface.

Attention is again called to the fact that this particular ganglion might have been an inflamed or distended bursa, since it was found free in the tissues, that is, there was no definite attachment to either tendon sheath or joint capsule. Consequently these questions at once come up. Have we been studying an actual synovial membrane, if the condition is an inflamed anatomical bursa? Have we been

studying a synovial membrane in process of development, if the condition is an inflamed adventitious bursa, or, have we been studying the lining of a cyst developed by a cause other than that which determines the origin of adventitious bursæ? Every one must admit that the lining of an anatomical bursa is a true synovial membrane. Only weak arguments can be advanced to refute the view that the lining of an adventitious bursa has become specialized to such an extent that the lining is also a true synovial membrane. It might even be claimed that the lining of the cysts described as occurring in any connective tissue is also similar to a synovial membrane; since, as will be mentioned later, the lining cells of synovial membranes are simply specialized connective tissue cells.

However this may be, in order to determine the presence or absence of endothelium, the significance of the silver markings, found both in relation to the free surface of this cyst and other free connective tissue surfaces, must be understood. These markings may be explained in four ways.

The silver salt might precipitate: 1. In lymphatic canaliculi, if such exist. 2. Around the ramifying fibrillar processes of the individual cells. 3. In the ground or intercellular substance. 4. In the threads of coagulated synovia or cyst contents on the free surface. There, of course, might be a combination of any of the above possibilities explaining the silver markings.

Silver nitrate, protargol, and other silver salts are usually negative in action, that is, they combine with substances lying between the cells. This diffuse precipitate encloses each cell, as the mortar in a wall surrounds a brick. The response of all connective tissues is not constant when treated with silver salts, apparently because of the variations in the ground or intercellular substance. The connective tissue of the cornea responds readily as a rule, and an even diffuse precipitation of the silver salts between the cell spaces is obtained. In the peritoneal mesothelium, the endothelium lining blood and lymph vessels, it is the substance between these superficial cells that first precipitates the silver salts, while the substance that attaches these superficial cells to the underlying connective tissue does not react as rapidly. Therefore, after treating the surface of the peritoneum and the inner lining of the intima of blood-vessels with silver salts, the result is the well-known picture of an orderly arranged network of fine serrated lines and not a diffuse layer of precipitate as in the cornea. This mosaic, characterized by narrow lines, is the usual criterion which determines the presence of endo- or mesothelial cells. The substance between the cells, which precipitates a silver salt, is commonly called cement substance and is said by Schäfer apparently to contain mucin. Recently the presence of this cement substance has been disputed. The substance between cells in connective tissue, such as the cornea, in which a diffuse precipitation occurs, is commonly called ground or intercellular substance. The inconstant response of the free connective tissue membranes, when treated with silver salts, accounts in part for the difficulty in drawing conclusions from the results.

In regard to these various hypotheses to explain the presence of the silver markings, I am aware that it is doubtful whether lymphatic canaliculi exist; and in addition there is no proof whatever that the silver salt is precipitated by lymph. Lymphatic vessels of the calibre of blood capillaries either end blindly or are arranged in loops as are the vascular capillaries. Canaliculi, if such exist, would necessarily be spaces between the cells on a very small scale if they simulated when impregnated the markings made by the silver salt, described above.

MacCallum, in an article on the relations between the lymphatics and connective tissue, reviews what has been written on the subject and questions the observations of v. Recklinghausen, when he states that the "Saftkanalchen" communicate directly with the lympathic vessels. It is doubted by MacCallum whether such lymphatic canaliculi exist. He goes on to say that, by a nuclear and protoplasmic stain, cell-bodies and fibrillar processes are shown to occupy the supposed lymph canaliculi. He closes his article with the statement that the major part of absorption from tissues or cavities, especially of solid particles, is brought about through the agency of phagocytes.

Delamere states: "It is now quite certain that the 'capillicu es' of Bartholin, Arnold, and Sappy, which are placed between the arteries and lymphatics, have no more existence than the 'juice canals' of Recklinghausen, or the 'serous vessels' of Boerhave. Contrary to opinion originally held by Mascagin and Bichot and at first adopted by Ranvier, it appears almost certain that the lymphatics have no openings in the meshes of the connective tissues."

The second explanation of the markings of silver, both on and beneath the free surface, namely, that the precipitate surrounds cell processes which anastomose thus producing a network of fine lines, is plausible.

The third explanation, that protargol may precipitate between individual cells, is certainly true, and the resulting picture depends on several things. The lining both of cysts and synovial membranes varies in structure, depending upon the amount of ground or intercellular substance, which determines the distance between the individual cells. Certain membranes are very cellular as shown in drawings Nos. 6 and 7 from cases 13 and 14; while others are made of a large amount of ground substance (Photomicrograph C, case 8). In a rather cellular specimen the impregnated ground substance is a narrow band or line between the cell openings. In any specimen the individual cell wall or so-called cement substance between the cell-body and ground substance is so acted upon by the protargol, that when contrast-stained with hæmatoxylin this cell margin becomes sharply emphasized (Photomicrograph C, case 8). Because of this, in specimens when the impregnation is not complete, fragmentary lines exist here and there, outlining individual cells. In drawing conclusions, therefore, much depends upon the preparation of the specimen, even after the above facts have been taken into consideration.

The fourth explanation, that protargol may precipitate in the thread-like lines of coagulated synovia or cyst contents, is also true. This occurs if the specimen is not carefully washed with water to remove the synovia or cyst contents, which are apt to coagulate in fine thread-like lines on their respective surfaces when placed in alcohol. This coagulated synovia or cyst contents precipitates protargol just as the ground or intercellular substance does.

In summing up the various explanations of these so-called silver markings, I have ruled out impregnated lymphatic canaliculi, since the latter do not exist. Many of the coarse silver markings are coagulated threads of synovia or cyst contents impregnated with silver salt. The fine lines, both on and beneath the surface, are at times the emphasized margins or outlines of individual cells and occasionally the silvered fibrillar processes of branching connective tissue cells. *Never, however, are the surface lines so arranged as to simulate, even in the slightest degree, the beautiful mosaic of silvered lines produced in the peritoneal mesothelium and the vascular endothelium by impregnation with a silver salt.*

Since I have disproved the presence of endothelial cells lining ganglia, by means of the protargol and silver nitrate, it is necessary to determine the character of the cells lining joint and other synovial membranes. I quote the following investigators. Fick mentions that Hammar in Upsala and Braun in Leipzig, have both discussed the question carefully. Fick goes on to say that joint-cavities are not lined by endothelium, meaning by that closely disposed flat cells, but by a free connective tissue surface. The inner lining or intima of the joint-capsule consists of pure connective tissue with many ramifying fixed connective tissue cells, which in the most superficial layer are placed fairly close together. The lining is shown in a drawing from Braun and the cells are spoken of as epitheloid, having either a broad or a narrow zone of intercellular tissue. The interesting statement is made by Fick that all the cells do not lie entirely on the free surface but many lie a little under the surface and are covered by intercellular substance.

Braun, in his article on the fine structure of the joints, describes the action of silver nitrate, and calls the lines which result silver markings. He believes that they outline the individual cells. His photomicrographs are similar to the results which I obtained by using protargol on linings of certain ganglia and also on synovial membranes, when the membranes were fixed without washing in strong alcohol.

Hammar's drawings of the silver markings,

in an article on the same subject, show the lines to be on the surface of the synovial membrane, and also running into the deeper parts.

Hueter, in 1870, stated that synovial membranes are connective tissue structures, and are lined by connective tissue cells.

We then have for corroboration, evidence of the action of silver salts on free connective tissue membranes, and also statements concerning the characteristics of the individual cells of joint synovial membranes. These latter will be considered again in detail.

To control the technique in the use of protargol, the peritoneum of adult cats and the pericardium of a child were used. The pavement or endothelial cells were readily demonstrated over large areas in an even and beautiful manner.

Having determined the value of protargol, normal synovial membranes, in the fresh state from a number of joints of various animals, were impregnated with the silver salt and counterstained. The object of this was to compare the lining-cells of ganglia and of synovial membranes.

An attempt was also made to determine by the microchemical reactions of stains, whether the surface cells of ganglia possessed any determinable differences from the surface cells of synovial membranes, and also whether these surface cells differ from their respective deep-lying connective tissue cells. It seemed possible that the degeneration or metamorphosis, said to be taking place in the surface cells of the above free connective tissue membranes, might give with appropriate stains characteristic color reactions.

To demonstrate, if possible by absorption, any lymphatic canaliculi, connecting the joint-cavity directly with the lymphatic system, lampblack and India ink, in suspension in water, and also protargol were severally injected into the shoulder joints of adult cats at various intervals before death. Different authorities have been consulted concerning the lining cells and the development of joint and other synovial cavities. Synovial membranes, at different periods of development, have been studied, to determine the histological structure and cellular lining; also two specimens of synovial membranes from pathological human knee-joints are described, since they might more closely resemble the pathological cells lining ganglia.

CASE 7. An adult rabbit's knee-joint in a fresh state was treated with protargol and an irregular network of brown lines was found similar to those described in Case 6. In addition to the above there were two areas which at first glance were apparently endothelial cells, or at least cells in a single layer sharply outlined by precipitated protargol in the so-called cement substance. Later observations showed that, although the cells were in islands which were apparently on the surface, as a matter of fact these cells were in two layers; also, and this is still more convincing, one or more canals lined by such cells entered each area or, in other words, these cells lined superficial vessels. The endothelial cells and coarse silver markings are shown in photomicrograph A.

I attempted to prove in the following cases whether the coarse silver markings described in Cases 6 and 7, were really due to the contraction of the tissue and the silver impregnation of the coagulated threads of synovia.

CASE 8. Adult hand. Within a short time after a traumatic amputation through the forearm, the synovial bursa invaginating the extensor tendons under the anular ligament was opened and irrigated with water. The bursa and extensor tendons were dissected away from their attachments and immersed in 2 per cent protargol for twenty minutes. The specimen was again washed in water and then placed in 40 per cent alcohol and exposed to the direct sunshine. Within one hour the synovial membrane, both visceral and parietal, turned a deep brown. The specimen was then passed through alcohols of increasing strength until fixed. A small section detached from the wall of the bursa was mounted without using a contrast stain. This section showed a diffuse brown ground substance with many round or oval cell openings, while other cells had processes running into the tissues. The individual cell spaces were separated by a large amount of ground substance. Photomicrograph B shows both the cell spaces and the ground substance. Sections were cut both tangential and at right angles to the surface of the parietal synovial membrane. The tangential sections were stained with hæmatoxylin and eosin, which demonstrated that the spaces described in the detached section were each occupied by one and frequently by two nuclei surrounded by a bright clear zone (Photomicrograph C). Cross sections also demonstrate the large amount of ground substance between the individual cells and show the distended cell-body most marked in those cells nearest the surface. This distention of the cell by some physiological body certainly seems to confirm the statement that synovia is produced, at least in part, by the continual sacrifice of these cells. Photomicrograph D shows a few of these distended cells, also the amount of ground substance which makes up synovial membranes.

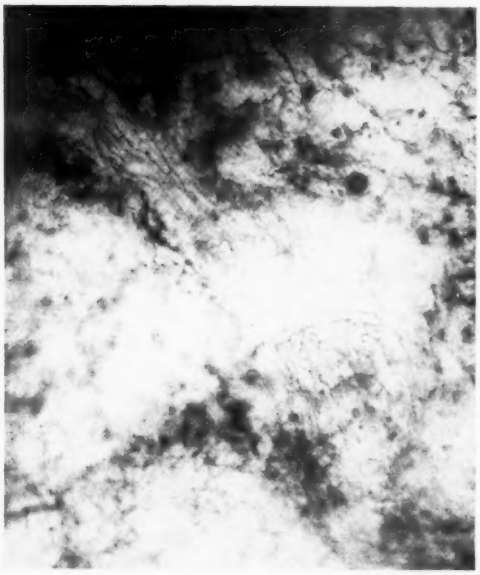

Fig. 4. Photomicrograph A. Case 7. Detached section of synovial membrane from a rabbit's knee-joint. The endothelial cells lining a collapsed superficial vessel are shown. Other irregular silver markings of coagulated synovia may be noted. Preparation: protargol impregnation. ×450. Cells average 18 x 35 micra.

These three photomicrographs show the cellular elements and the ground substance of synovial membranes and do not even suggest an endothelial lining.

Sections from all the cases reported in this article, that is, sections of the knee-joint and tendon sheath synovial membranes from pathological and normal cases, also sections of ganglia and bursæ, were severally stained with polychromethylene blue, thionin, Bismarck brown, and mucihæmatin, to differentiate if possible, by microchemical reactions, the superficial from the deep cells. In each case the result was negative. The above stains give a microchemical reaction, with various degenerative and physiological substances as hyalin, colloid, mucus, and mucin. These stains were tried, notwithstanding the statements of Hammarsten and others who have found the main element in synovia to be a mucin-like body, not true mucin, which would not necessarily react to any of the above stains. The specimens mentioned above were fixed in alcohol, formalin, or Orth's fluid. To rule out the possibility that the fixatives used interfered with the microchemical reaction of the dyes, frozen sections of synovial membrane were prepared from the shoulder joint of a freshly killed adult dog, and polychromethylene blue, thionin, Sudan III, and picro-acid fuchsin were used. With each dye, a negative result was obtained.

To define, if possible, any existing lymphatic canaliculi, I injected about 20 cmm. of powdered India ink and water into eight shoulder joints of live adult cats, since foreign particles might be carried into the canaliculi. The joints were removed and placed in a fixative, some as early as thirty minutes, and some as late as three hours and thirty minutes after injection. One additional joint was injected with lampblack and water, and this joint was removed in two hours and twenty minutes. All the sections were cut either at right angles or tangential to the synovial surface, and showed a very diffuse impregnation of the tissues and synovial surface with the foreign

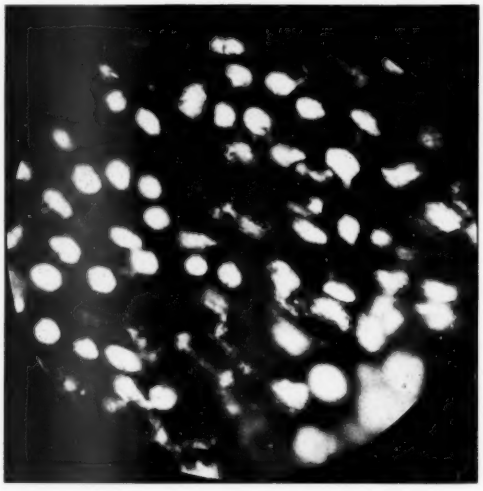

Fig. 5. Photomicrograph B. Case 8. Detached section from superficial surface of normal synovial membrane under annular ligament, enveloping extensor tendons of the fingers. Ground or intercellular substance alone shown, impregnated with silver. The cells are represented by the openings. Preparation: protargol impregnation. ×500. Cells average 15 micra in diameter.

particles. These particles had no definite arrangement that was recognizable. I believe the foreign particles may have been injected into the tissues as well as into the joint-cavity, which would diminish the value of the conclusions.

Protargol (10 cmm. of a 2 per cent to 4 per cent solution) was also injected into seven shoulder joints of adult cats, in the hope that during life the cement substance between the cells might more readily precipitate the silver salt. Some joints were removed as early as five minutes, and some as late as two hours and twenty minutes after injection, and then placed in the sunshine. Although the sections showed typical pictures of inflammation, the protargol evidently coagulated the synovial fluid on the surface of the membrane, so that in neither detached specimens nor tangential sections was there any cell outline defined. All the above sections were observed both with and without the use of contrast stain.

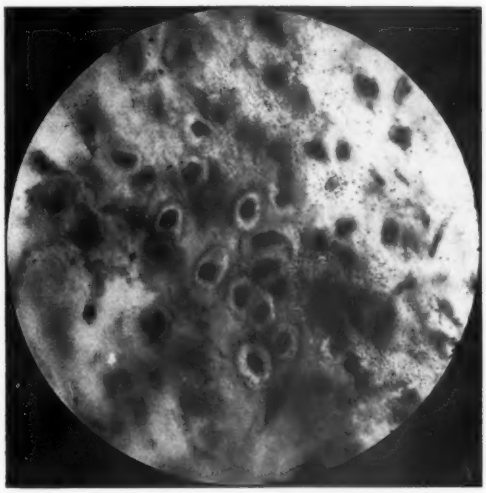

Fig. 6. Photomicrograph C. Case 8. Tangential section of normal synovial membrane enveloping extensor tendons of the fingers. The distances between the individual cells are shown. The fine granules are the precipitated protargol. This photomicrograph differs from the preceding in that the cell-bodies and nuclei of the cells are stained. Preparation: protargol impregnation: hæmatoxylin and eosin stain. ×500. Cells average 15 micra in diameter.

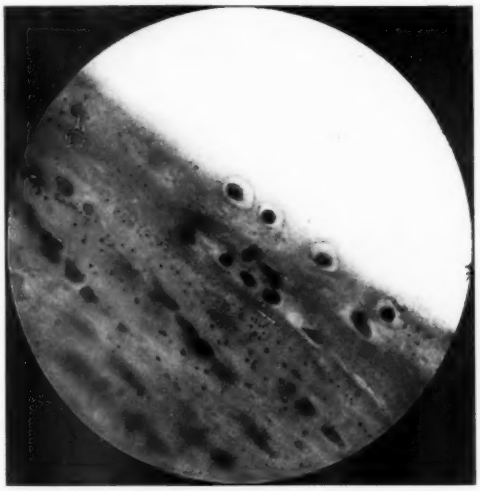

Fig. 7. Photomicrograph D. Case 8. Cross section of synovial membrane under annular ligament enveloping extensor tendons of the fingers. The large cells and the amount of ground or intercellular substance, dotted with the protargol granules, are shown, also the different characteristics of the superficial and deep cells. Preparation: hæmatoxylin and eosin stain. ×500. Cells average 15 micra in diameter.

IV. REVIEW OF THE EMBRYOLOGY OF JOINTS AND THEIR LINING CELLS

This is introduced to exemplify the development of synovial cavities and the histological elements of synovial membranes, as set forth by many authors.

Minot states that the cells in the embryo undergo a mucoid degeneration where the joint-cavity is to be. At the side of the cavity the mesenchyma forms the synovial membrane, which is merely very vascular, fibrillar connective tissue; upon the synovial surface, patches of endothelium are developed. He seems to think that the crowding of the mesenchymal cells is the deciding point in the development of the endothelium, as follows: "The degree to which this tendency is evinced varies extremely, and we may have the cells either simply crowded, or converted into an endothelium in patches, or wholly endothelium. The transition from one form of tissue to the other can be seen in the adult synovial cavities, and is important as additional evidence of the

slight real difference between mesenchyma and epithelium."

Hagen-Torn, in speaking of the development of the joint, also mentions the mucous degeneration of the cells, which aids in the formation of synovia. He adds: "The development of the tissue found in the joint and around the tendons goes hand in hand with that of the subcutaneous cellular tissue in which the bursæ are formed. The microscopic structure of each is always the same. I was, however, unable to recognize an entire endothelial lining for the synovial membrane, this, on purely morphological grounds. To fit our ideas of endothelium the whole surface should be covered with cells not in patches." Later, in speaking of synovia, he says: "There are found suspended in the fluid many cells having the same form as the cells of the synovial membrane. At times fat globules and again hyalin spheres are found in these suspended cells."

Stohr speaks of the cells on the synovial membrane as epithelial. The synovia, he claims, contains more or less profoundly altered cells, fragments of cells, and oil globules, all the product of physiologic processes of waste of the surfaces of the synovial membrane and articular cartilage.

Szymonowicz says that the synovial membranes are covered with one or more layers of large, flat, epithelial cells. He uses the terms endothelium and epithelium as synonomous when the cells are flat and joined together by a minimum amount of intercellular substance, mentioning the fact that flat epithelial cells, which come from the middle germ membrane, line the joint-cavities and the blood and lymph channels. He considers, therefore, epithelium a better designation than endothelium, preferring to name cells from their characteristics when mature rather than from their histogenesis.

MacCallum considers the specificity of endothelial cells and believes very little can be definitely stated. He goes on to say: "There is certainly a morphological differentiation at a very early stage and one does not escape the impression that the differentiation visible thus early is more than a morphological one and that these cells retain their endothelial nature as distinguished from the surrounding connective tissue cells throughout all the processes of proliferation and development through which they go."

From the above statements it is evident that we do not all mean the same thing when we use the term endothelium. It is necessary, therefore, to frame some definition. As I understand it, endothelium consists of highly specialized flat cells in a single complete layer, covering or lining a free surface, supported by tissue which differs essentially from these cells. The material between these endothelial cells precipitates silver in such a manner that dark serrated or wavy lines result, producing a characteristic mosaic.

On the other hand, the cells of a synovial membrane are specialized to a certain degree, becoming less and less specialized as the distance from the synovial surface is increased. Also these cells are not in a complete layer and vary both in shape and size.

It is seen that the lining cells of blood-vessels and the flattened connective tissue cells of synovial membranes differ essentially, notwithstanding the fact that they both sprang originally from the mesodermal layer in the embryo. The nomenclature of these two groups of adult cells, therefore, cannot be decided because of their histogenesis. In other words, there is no sharp demarcation, morphologically, between the surface synovial cells and the underlying connective tissue cells, such as there is between the endothelial cells of the blood-vessels and the underlying supporting connective tissue cells.

Cases 9, 10, 11 and 12 are introduced to show the following facts: No. 9, the development of a joint and its lining cells; No. 10, the cells in joints and also the structure of the synovial membranes; No. 11, the same as number 10; No. 12, the existence of certain crypts in adult tendon sheaths, claimed by many to be an etiological factor in the development of ganglia.

CASE 9. A developing finger-joint in a human fœtus. Neck rump measurement, 18 mm. Fingers distinct, measuring 1.5 mm. in length. Longitudinal sections through index finger showed the incipient joint-cavity between the distal and middle phalanx as a transverse narrow homogeneous area. On either side of this incipient joint-cavity there was a layer of round cells (Drawing 4).

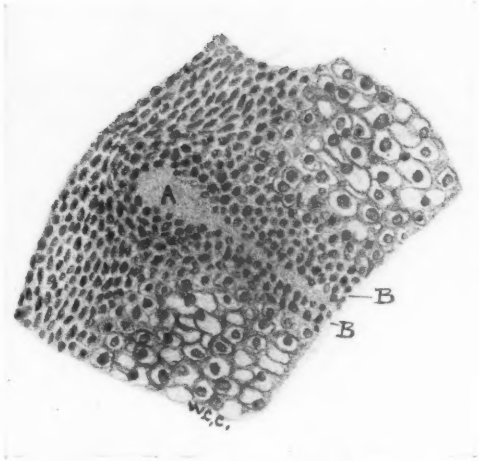

Fig. 8. Case 9. Cross section of fœtal finger joint; neck rump measurement 18 mm. Incipient joint-cavity *A* lined by mesodermal cells *B* which are sacrificed as the joint-cavity enlarges. Preparation: hæmatoxylin and eosin.

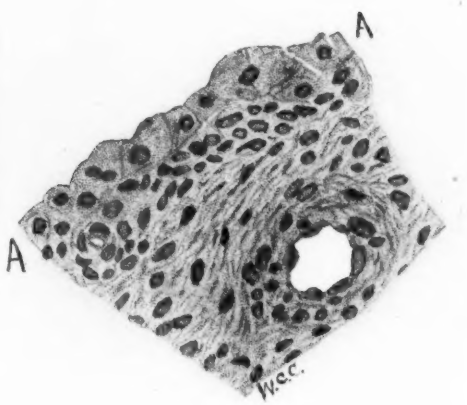

Fig. 10. Case 13. Cross section of synovial membrane covering hypertrophied papilla from a knee-joint in a condition of chronic synovitis. The lining cells *A* and *B* vary in shape and are in several layers resting on a loose connective tissue framework. Preparation: hæmatoxylin and eosin.

Case 10. Human fœtus, 12 cm. long, on which the fingers were fully differentiated. Sections through wrist. Connective tissue, very delicate in structure, immediately surrounded the extensor tendons. Where a synovial cavity was developed this same delicate connective tissue surrounded each cavity. In each condition the connective tissue at a distance was dense and supported this more delicate tissue, which allowed for the excursion of the tendons where a synovial cavity did not exist.

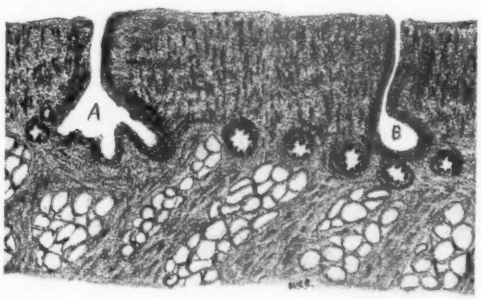

Fig. 9. Case 11. Longitudinal section of parietal synovial membrane from a flexor tendon of a finger. Full term baby five days after birth. Two crypts *A* and *B* are shown in the synovial membrane, with distended pockets at the deepest points and narrow outlets. Preparation: hæmatoxylin and eosin.

Case 11. A full term baby, five days after birth, was injected with formalin, 2 per cent, shortly after death. Sections through wrist-joint. The synovial membrane lining the capsular ligament was smooth, but at the same time thrown up into one or more folds in each joint to allow for motion. Longitudinal section through the flexor tendons of the second finger over the proximal phalanx. There were found a number of pockets or folds in the parietal synovial membrane. The base of each pocket was distended and the walls were in apposition at the outlet into the tendon cavity (Drawing 5). These pockets or folds were wholly in the substance of the tendon sheath itself. The cells lining these pockets were distinctly connective tissue and the synovial membrane rested on a fat-infiltrated connective tissue framework.

Case 12. Adult flexor tendon and sheath. Formaline preservation. Longitudinal sections through flexor tendon and sheath. The parietal synovial membrane was thrown into a number of folds with deep crypts between. The tissue bounding such crypts was dense and sharply outlined from the surrounding tissue of the tendon sheath.

These observations agree with the views of the writers already quoted; namely, that joint and other synovial cavities are formed by the sacrifice of cells in the tissue which is ultimately connective; that there are many folds and crypts in synovial membranes which

Fig. 11. Case 14. Cross section of synovial membrane, covering a hypertrophied papilla from a knee-joint in a condition of chronic synovitis. Cells *A* and *A* are distorted and irregular in shape, due to the fact that the specimens are fixed in strong alcohol. Preparation: hæmatoxylin and eosin.

could become occluded; and that joint synovia and its containing cells are not unlike the contents of ganglia.

Cases 13 and 14 demonstrate the cells as they occur under pathological conditions covering the villous growths in the knee-joint.

CASE 13. An adult female, operated upon at the Roosevelt Hospital by Dr. J. A. Blake, March 6, 1906, for chronic arthritis of the left knee.

Operation. Hypertrophied villi were removed for diagnosis and preserved in formalin 4 per cent.

Microscopic Examination. Hæmatoxylin and eosin stain. Longitudinal sections of the papillary processes.

Low Power: Each process was largely adult fat, supported by a slight framework of connective tissue, and was invested by a distinct connective tissue covering.

High Power: The covering cells, in several layers were large, irregular, and sharply outlined. Drawing 6 shows the cells and the sharp line of demarcation between the investing cells and the deep tissue.

CASE 14. An adult male had chronic arthritis of the right knee for three years.

Operation. Lincoln Hospital; Dr. A. V. S. Lambert, March 4, 1906. The joint was opened and many long, slender, villous processes were removed and fixed in 80 per cent alcohol.

Microscopic Examination. Haematoxylin and eosin stain. Longitudinal sections of the papillary processes.

High Power: A vascular connective tissue framework supported a distinct layer of cells. Drawing 7 shows the general characteristics of the investing cells.

The synovial cells in these two cases are totally different morphologically, demonstrating what peculiar shapes connective tissue cells may assume, presumably owing to variations in pressure.

The next case is of value because it demonstrates the type of bursa that develops where regularly described or anatomical bursæ do not exist, formed in connective tissue in response as it were to trauma or constant irritation.

CASE 15. An adult female applied, May 8, 1906, at the Roosevelt Hospital Out-Patient Department, because of a hammer-toe, the end of which was covered by a large corn.

Operation. Ether anæsthesia; Dr. Karl Connell. The toe was amputated.

Gross Examination. A bursa was found under the corn, between it and the end of the terminal phalanx. When the bursa was cut in half a small amount of glairy fluid escaped. One portion of the bursa was washed in water and an attempt made to impregnate the tissue with protargol; the result, however, was disappointing. A simple diffuse precipitate was obtained. The balance of the specimen was fixed in alcohol 80 per cent, and sections were cut at right angles to the free surface.

Microscopic Examination. Hæmatoxylin and eosin stain.

High Power: The cavity of the bursa was separated from the epithelial columns of the corn by an interval of tissue. The actual lining of the bursa was finely fibrillated tissue, supported by a poorly stained connective tissue framework. There were no nuclei or distinct cell-bodies in the lining itself and the tissue in this lining was similar to tissue frequently found adjoining areas of so-called cystic degeneration in fibromata.

The phase of degeneration in the wall of this bursa was not the same as that noted in some of the ganglia quoted and described. In many of the latter, the lining cells were swollen and

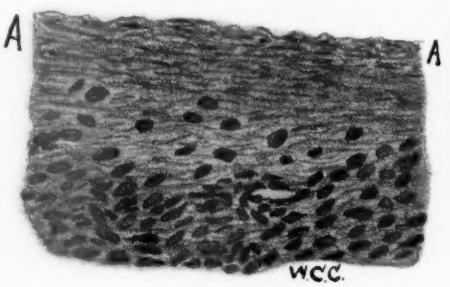

Fig. 12. Case 15. Cross section of wall of an adventitious bursa occurring under a corn. The nucluei of the cells *A* and *A* lining the cyst do not stain because of the degeneration taking place. Preparation: hæmatoxylin and eosin.

distended, while in this adventitious bursa, a slow gradual atrophy was taking place (Drawing 8). I believe that the phases of degeneration found in such conditions depend upon the length of time the process has existed, and also upon the rapidity with which the condition has developed.

I am convinced that the cyst was not a dilated lymph space but had been formed, as it were, by a melting away of the tissues. This is mentioned since it is stated that synovial cavities, especially such as adventitious bursæ, are simply dilated lymph spaces. That adventitious bursæ are not dilated lymph spaces, does not seem possible in the face of Tillmanns' description of bursal development and Minot's conception of joint development. In other words, they believe that synovial cavities are hewn, as it were, in the mesodermal or connective tissues, wherever required. It certainly seems more probable that repeated trauma would cause destruction of cells, thus forming a cleft in the tissues rather than cause the dilatation of a lymph vessel. If dilated lymph spaces were the true genesis of synovial cavities, the endothelial lining, claimed for them by many, might be present.

The following is a description of the lining cells and the structure of an inflamed prepatellar bursa.

CASE 16. An adult male presented himself, September 10, 1904, at the Roosevelt Hospital Out-Patient Department, because of a chronic prepatellar bursitis.

Operation. Cocaine anæsthesia; Dr. Walton Martin. A thick-walled cyst was removed from the front of the patellar through a longitudinal incision.

Gross Examination. The cyst contained clear fluid and its walls were festooned with many villous and papillary processes. Alcohol, 80 per cent, preservation.

Microscopic Examination. Sections of the lining processes showed that these were rather dense connective tissue. The actual lining cells, elongated and somewhat flattened, were in three or more layers. No sign of degeneration existed in any part examined. The lining cells in this cyst, except for their shape, were duplicates of the cells in Case 12 and 13, and were similar to the lining cells of ganglia of long standing.

V. CONCLUSION.

In Section III of this article, each hypothesis, explaining the pathogenesis of ganglia is discussed and many features are noted which tend to substantiate or disprove each explanation. In what follows I have reviewed those features and certain other facts from my personal investigation as set forth in Sections III and IV, in order that the most reasonable theories may be chosen.

The hernial hypothesis has been evolved since ganglia seem to be lined by a synovial membrane and contain synovia, appear suddenly, have been supposed regularly to communicate with a joint or tendon sheath cavity, and occur in persons of delicate build whose wrists are exposed to strain. This hypothesis is substantiated by the fact that an endothelial lining is said to exist in ganglia, and by a chemical similarity between ganglia contents and synovia. This hernial hypothesis may be rejected in the majority of cases for the following reasons: Ganglia very rarely have a hernial neck; rarely communicate with an adjacent synovial cavity, according to Falkson, Ledderhose, Thorn, and Payr; rarely can be emptied by pressure; are frequently multilocular; and similar cysts occur at a distance from synovial cavities.

The dermoid hypothesis, as applied to synovial membranes by Hoeftmann and mentioned by König, has been refuted. The observations of Minot, Hagen-Torn, and others, on developing joints, show that joint-development is a melting away of tissue and not an upbuilding from specialized cells. This controverts the dermoid hypothesis because of the absence of specializing factors necessary to call forth additional synovial cells at a distance from synovial membranes, if by chance synovial membranes were sequestrated. This is confirmed and illustrated by the description and drawing of the forming joint reported in Case 9.

The hypothesis, that folds or crypts in synovial membranes may form retention cysts, has been advanced by Chaput, Volkmann, and Virchow. That such crypts or pockets do exist in the synovial membrane of the flexor tendon of the finger is proven by Case 12. If the distention of these crypts or pockets were the uniform origin of ganglia, the absence of communication between such cysts and synovial cavities would be an argument in favor of such an hypothesis. The lining of such cysts would be synovial and they would

contain synovia. Also these cysts, as already commented upon, would have to pass through or between ligaments and capsules of joints and through tendon sheaths, to be found external or superficial to the above structures. In other words, the arguments both refuting and sustaining this hypothesis are exceedingly meager.

The hypothesis that such cysts are hydrops of anatomical or adventitious bursæ has many points in its favor. Such cysts would be lined by a synovial membrane; would contain fluid which is apparently synovia; would be found external to the capsules of joints and sheaths of tendons; and would be free in the tissues. The fact that adventitious bursæ occur must be allowed (Case 15), and it is stated that Velpeau found some fourteen anatomical bursæ on the dorsum of the wrist alone. Cases 10, 11, and 12 demonstrate the loose structure of the connective tissue layers on the dorsum of the wrist around the extensor tendons. This loose connective tissue allows for the excursion of the tendons in tissues where synovial membranes do not exist. Therefore this region on the dorsum of the wrist is favorable for the development of adventitious bursæ and is, according to Velpeau, well supplied with anatomical bursæ. The distention of any well-recognized bursa, such as the prepatellar, because of acute serous inflammation is usually rapid, and this readily explains the sudden appearance of certain ganglia. On the other hand, if all ganglia were inflamed bursæ, whether anatomical or adventitious, they would not frequently be multilocular; would not be attached by a pedicle or sessile base to capsular ligaments or sheaths of tendons; and would not occur within tendons themselves, as described by Thorn, Franz, Borchardt, Morestin, Hofmann, and myself.

The last hypothesis, that ganglia are formed by cystic degeneration, is acceptable to Ledderhose, Thorn, Payr, Franz, Borchardt, Hofmann, and Ritschl, all of whom are investigators of recent times. Such cysts, formed in this manner, might be multilocular; would not communicate with tendon sheath or joint cavity; would be lined by connective tissue cells, undergoing degeneration; might contain fluid physically similar to synovia, according to Reidinger, Tillmanns, and others; and might occur in peritendinous, tendinous, periarticular, and aponeurotic structures at a distance from a synovial membrane. On the other hand, ganglia due to cystic degeneration in capsular ligaments or tendon sheaths should not be found free in the tissues as described in Case 6; nor apparently should they be lined by cells specialized to such a degree that they simulate endothelial cells so closely as to be called such by König, Ledderhose, Maisonneuve, Verneuil, and Witzel.

I desire to discuss for a moment the various investigations, which I made to determine if possible the characteristics of the lining cells of ganglia and their contents, since former investigators were greatly influenced by the evidence deduced from such a study. Concerning the lining cells, König alone described the technique used to determine whether endothelial cells are present or absent. Ledderhose and others simply state the lining to be endothelium. Falkson, Thorn, Payr, and Hofmann controvert this, believing with Ledderhose, Riedel, Franz, Borchardt, and Morestin, that the lining cells are connective tissue passing through various phases of degeneration. Thorn comments on Ledderhose's statements that the lining cells are endothelial, and that ganglia are formed by cystic degeneration. If the latter be true, Thorn says, the term endothelium signifies to him something different from what it signifies to Ledderhose. The attempt is made to prove or disprove the presence of endothelium, in order to determine the relation of ganglia and synovial membranes. I am convinced from my investigations with protargol that synovial membranes are not covered by endothelial cells, but, as already stated and shown in microphotographs, by specialized connective tissue cells and a large amount of intercellular or ground substance. This agrees with the statements of the most recent investigators, such as Fick, Braun, and Hammer. Obviously, if synovial membranes are not covered by endothelium, ganglia are not lined by endothelium, and only in certain instances are ganglia lined by cells specialized to such a degree as to simulate synovial membranes.

Morphologically the cells lining bursæ,

joint synovial membranes, and certain types of ganglia, are similar. That the morphology of such cells can ever be gauged with such exactness as to distinguish between the above regions, is questionable, when it is recalled that the delicate protoplasmic cell-bodies, situated in such exposed positions, are susceptible to slight changes in pressure, thus varying their shape. The drawings from Cases 13 and 14, indicate this fact. As regards the many statements, that both ganglia and synovial membranes are lined by endothelium, I am convinced that certain observers may have been misled by areas of endothelial cells which line superficial lymphatics and small veins. These vessels are collapsed in each detached section, whether from synovial membranes or ganglia; therefore their endothelial cells are exposed to view, flattened out just under the transparent superficial connective cells of the section. This fact is demonstrated in Case 7, and was also observed in other detached protargol specimens of freshly prepared synovial membranes.

The attempt made with stains which react to various degenerative products or physiological substances, to determine if possible whether synovial cell-bodies possessed any characteristic traits, was negative. Therefore, with the stains at hand to-day, I am convinced that it is impossible to recognize synovial cells as such, either from a morphological or a microchemical standpoint.

The contents of ganglia are sometimes thick and gelatinous, at other times thin, mucilaginous, and sticky, chemically similar to the contents of a cyst in the periosteum. Reidinger, describing such a cyst, used the title "Ueber Ganglion periostale" and many other such cysts have been reported. When the varied statements of Thorn, Franz, Ledderhose, Borchardt, Payr, and Reidinger are recalled, as to the presence of mucin, mucus, and colloid in ganglia, it is obvious that either the microchemical tests are inexact or the contents of ganglia and other connective tissue cysts vary greatly. As already indicated, according to Hammarsten, the exact nature of the essential element in synovia has not been determined. Minot speaks of the process by which fœtal joints are formed, as mucoid degeneration. Hagen-Torn states that a mucous degeneration takes place in the lining cells of joints to furnish synovia. Therefore, nothing has been proved from a study of the contents of ganglia other than that all the connective tissue structures are capable of developing cysts whose contents are physically similar and chemically indistinguishable.

The characteristics of the lining cells and contents show that many ganglia are formed, beyond a doubt, from degeneration of connective tissue cells. The excitant is still unknown and to be discovered, the question must be attacked from some other side than the mere study of the resulting cysts. Attempts have been made, with negative results, to prove by inoculation with the contents of a ganglion, whether the cystic degeneration may not have been caused by bacteria. It has also been suggested that periosteal and other degeneration cysts may arise from the same cause. However this may be, it is also possible that the excitant may be trauma repeatedly incurred.

Recalling the varied situations of the cysts reported and spoken of as ganglia, it is obvious that the term ganglion is a poor one. It is indefinite since it is used to designate these cystic tumors, variously situated, and also parts of the nervous system. It would seem admissable, however, since the term is so generally accepted, to speak clinically of cysts, on the dorsal and palmar surfaces of the wrist and dorsum of the foot, as ganglia, but to restrict the term to them.

In summing up the theories of the pathogenesis of ganglia, evolved from various hypotheses considered above, I believe that in regard to the hernial theory it would be presumptuous, in the face of Pick's observations, to assert that no such synovial protrusion has ever existed, causing a ganglion; but it must be added that the condition is exceedingly rare. As to the remaining theories I am positive that many ganglia are distended anatomical or adventitious bursæ, but the majority are connective tissue cysts, formed by degeneration, excited by unknown factors. In other words, I am convinced that ganglia are very rarely hernial protrusions of synovial membranes, frequently distended anatomical or adventitious bursæ, most frequently degeneration cysts.

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IMMEDIATE VERSUS DEFERRED OPERATION FOR INTRAABDOMINAL HÆMORRHAGE DUE TO TUBAL PREGNANCY[1]

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IN discussing the subject of the treatment of intraperitoneal hæmorrhage from tubal rupture or abortion, we must take into account the amount of blood effused into the peritoneal cavity in each individual case. As we all know, this varies within very wide bounds, depending upon the portion of the tube which has been ruptured or eroded. Again, we know that in tubal abortion the quantity of blood poured into the general peritoneal cavity at times may be very great, equaling in amount that occurring in the most severe form of tubal rupture. This is not a matter of mere theory but of actual observation by different operators. We know also that the raw area of a tube which has ruptured or has been eroded will go on bleeding for an indefinite time, or the bleeding may cease for a time, to be renewed again after the lapse of a variable period. This renewed bleeding may take place while the patient is at rest in bed, and has been known to occur even while the patient was asleep. Of course, it is more likely to occur after some slight exertion or after a bimanual examination which need not be carried out with any undue violence. As a matter of experience, we know that in the vast majority of cases the amount of blood effused into the abdominal cavity either from abortion or rupture is not so great as to be a direct menace to the life of the patient. Still, with the lesser degrees of intraperitoneal hæmorrhage, the attendant symptoms may be quite alarming and may simulate, in a marked degree, those attendant upon the more copious effusions. There will apparently be the same degree of pallor, the patient may go into apparent collapse and the pulse may become imperceptible. But in these cases reaction will occur within a comparatively short time. The acute observer will be able to note in these cases that the symptoms of collapse were due to the shock attendant upon the impact of blood upon the peritoneum rather than to acute anæmia.

Now, whether we operate upon these cases—forming about 95 per cent of all the cases that come to the operator—shortly after the hæmorrhage has taken place or wait for a day of two to suit the exigencies of the case or the convenience of the operator, or the service in the hospital, in my opinion, matters but little. Theoretically, the results ought to be better if time be taken for the preparation of the patient, and I am not inclined to split hairs upon this point. So far as my own experience goes, my emergency patients have gotten well equally as satisfactorily, and often more so, than when they had been subjected to preparations for a couple of days before the operation. I think we learned from last year's discussion, in this society, that the active preparation of the patient prior to laparotomy, to which many laid such store, was a fetich and often did more harm than good. This I do know, that since we have given up the active purgation and preparation of the patient formerly in vogue in the hospital, our patients have suffered much less from meteorism and other discomforts following abdominal sections. From what I have said thus far, it is evident that there is not much room for a difference of opinion as to the time of operation in about, roughly speaking, 95 per cent of the cases, that is, if we assume that all cases of tubal rupture or abortion ought to be operated upon. Whether this assumption is a correct one will be discussed later.

It is, then, in the treatment of the remaining 5 per cent that the bone of contention is to be met. This percentage is composed of the cases of tubal abortion or rupture in which the amount of blood effused is so great as to inundate the entire abdominal cavity, distending it to its greatest extent, pushing the diaphragm upwards to such a degree as to seriously crowd the heart and lungs, and placing the life of the patient in the greatest jeopardy or killing her outright from one to twenty-four

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hours. These cases the writer has termed "cataclysmic," from the suddenness of the event and from its overpowering character. In operating upon them it is like cutting through the abdominal wall of a corpse, the tissues being practically bloodless. When the peritoneum is reached, it is found of a very dark color and bulging outward and when incised the blood spurts out with considerable force. The patients are either apathetic, and partly or wholly unconscious, or are restless and in great anxiety. The countenance is of a sickly, livid color or deathly white, the muocus membranes of the lips and eyes are completely blanched and the pulse is very small, soft, and rapid, or is totally absent in the vessels at the wrist.

The assertion has been made that no matter how alarming the condition may apparently be, the patient seldom dies if the spark of life be not extinguished by surgical intervention. I cannot dismiss the thought that the gentlemen who make such an assertion have mistaken the cases with moderate and even profuse intraperitoneal hæmorrhage attendant with symptoms of collapse for the class I have just described. My suspicions receive support when these gentlemen place cases with a hæmoglobin of 55 and 65 per cent into this class, in which the percentage of hæmoglobin is usually less than 30 per cent or almost nil. Further support of my suspicion is obtained from the statement that six such cases were met with in a total of 20 cases. This, no doubt, can be better understood when the writer states that during the past ten years he has operated upon 84 cases, 20 of which were attended with copious intraperitoneal hæmorrhage. Of these 20 cases, in only 6 would he consider the hæmorrhage was so great as to entitle them to be placed in the cataclysmic class. That the patients belonging to this class will often die even if not operated upon, one has only to recall his own experience, or to glance through the literature for a single year.

The only case in my experience that died from intraperitoneal hæmorrhage was the one I did not operate upon, not being able to obtain consent until it was too late; while the other 6 cases operated upon immediately made prompt recoveries. I had only one death in the entire series of 84 cases and that patient died three weeks after the operation from an ether pneumonia.

As an argument in support of the assertion that patients rarely die from hæmorrhage in ectopic pregnancy, an analogy has been drawn between the hæmorrhage in gastric ulcer and intestinal perforation in typhoid. It is stated that death from hæmorrhage in these conditions is extremely rare. Let us see what the most recent and reliable statistics — those collected by J. H. Musser in his paper before the congress of American Physicians last year — show in this connection. The mortality in acute large hæmorrhage in gastric ulcer is placed by Musser at 22.4 per cent. Osler, quoting the result of 2,000 autopsies in typhoid in Munich, states that death occurred from hæmorrhage of the bowel in 99 cases, that is, in over 20 per cent. It was the cause of death in 11 cases in 56 deaths in Osler's cases, which is also about 20 per cent. In perforation of the intestines in typhoid there is practically no hæmorrhage and the mortality of this complication is caused by peritonitis. The analogy therefore was not a happy one. But we need no comparisons to tell us how fatal a disease ectopic pregnancy is when left alone. We need only to look up the pages of the celebrated work by Parry in which 500 cases are analysed. A hundred and sixty-three of these recovered and 336 died (67 per cent). There were a hundred and seventy-four deaths, or fifty-two per cent, from rupture of the gravid cyst.

R. Werth, of Kiel, whom no one would accuse of not being conservative, says in this connection: "Operative gynecology has effected a genuine triumph in instituting an active treatment in the life-threatening hæmorrhages within the peritoneum consequent upon tubal rupture, more rarely upon tubal abortion. "Formerly," he adds, "we stood helpless in the face of such a catastrophe and at least 80 per cent of the victims succumbed to it." No one will deny that the patients rarely die from the first intraperitoneal hæmorrhage, for the bleeding will generally cease when the heart's action is greatly depressed, but the eroded vessels will begin to bleed again as soon as the heart regains some of its power. It requires but a little extra loss of blood to extinguish

the life of these patients. The question of shock, in these cases, is to my mind a bugbear which we need not take into serious consideration. What would we think of an operator who would fear to reopen the abdomen to arrest a postoperative hæmorrhage because the patient was in deep shock from just having been subjected to a serious and lengthy operation? We know, and most of us by experience, what would happen if we should wait for the patient to rally or if the condition had not been diagnosed in due time. We need no experiments on the lower animals to teach us what the outcome in a human being would be, if the ligature should slip off, either from the ovarian or uterine arteries. We have seen patients brought to death's door and beyond it from the bleeding of very much smaller vessels and even from the cut edges of the vaginal wall after a total hysterectomy, and from a tear in one of the veins of the broad ligaments. Personally, I have been very fortunate in this regard, never having lost a patient from postoperative hæmorrhage, and not having even encountered it during the first ten years of my active work. But during the past two years I have had quite a few cases and I feel that the lives of my patients were saved by my promptly reopening the abdomen and arresting the bleeding points. And I feel exactly in the same way about my prompt action in the six cataclysmic cases of ectopic pregnancy that have occurred in my practice. I wish to add here, however, that I lay great stress in these cases upon an intravenous saline infusion, expeditiously and skillfully given. I use the latter adjectives advisedly. For I have seen experienced and skillful surgeons make a sad botch of this apparently simple procedure, and lose over it very valuable time during which the patient's life had time to ebb away. As a rule, the senior hospital interne, or graduate can carry out this manœuvre with the greatest dispatch and dexterity. This I deem one of the greatest advantages in having the patient in a hospital. The danger of infection in operating in the patient's home I consider slight, and in one of the worst cases in my series I was compelled to do so with only the kit of instruments for an ordinary curetting at hand. Although the abdominal wall was very thick and fat, there was primary union of the wound. But I feel convinced the patient would not have survived, were it not that Mount Sinai Hospital was close by, and I was able to have a couple of internes come almost immediately and administer an intravenous saline infusion in either arm. A word more about the catchy phrase of adding shock to shock. When the surgeon meets with a case of injury to the intestine, let us say a gunshot wound or an incarceration, he is not deterred by the shock which may be very profound from opening the abdomen at once so as to cleanse the peritoneal cavity and repair the injury. The proportion of recoveries will be in direct ratio to the promptness with which he has been able to act.

I think we gynecologists would be taking a long stride backwards in surgery if we were to adopt the measures of delay recently advocated with such warmth. We would be going back at least twenty-five years, if we deemed it necessary to place our patients in a state of hibernation for six or seven weeks to build up the "reserve force" so that they could withstand the ordeal of an abdominal section for a condition which, in most cases, calls for the simplest technique.

What is there easier and simpler in gynecological surgery than the technique necessary for a recent rupture of an ectopic tube. The only skill necessary is that no undue violence be used so that the broad ligament, which may be very friable, may not be torn, and that the ligature be applied tightly so that no further hæmorrhage will take place and that too much time be not lost in trying to cleanse the abdominal cavity of its blood and blood clots.

In summing up, I would say that in the vast majority of cases of intraperitoneal hæmorrhage from tubal rupture or abortion, it matters but little whether we operate at once or defer operation for a few days. But in the class of cases termed cataclysmic immediate operation, with intravenous saline infusions by an experienced operator, will be attended with better results than when operation is deferred for days or weeks.

DEFERRED OPERATION FOR INTRAABDOMINAL HÆMORRHAGE DUE TO TUBAL PREGNACY[1]

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WE should never lose sight of the fact that the judgment, skill, facilities, and locality of the teacher very often differ widely from those of the students who go out to apply the principles he has taught them. This, in large measure, leads to varying methods of accomplishing a given purpose and accounts for divergent views regarding the treatment of tubal pregnancy.

In the writer's judgment there can be no rule of thumb, no single plan of action which can be wisely applied to all cases under all conditions.

To indicate at the outset the line of thought this paper embodies, I submit four general propositions:

1. Extrauterine pregnancy is always a grave affection and operation should usually be done at the earliest elective period and under elective conditions.

2. It seems within the range of possibility that, by a readjustment of teaching regarding early symptomatology and prognosis, the vast majority of the cases may be recognized and appropriate treatment instituted during the non-tragic, which is the safe stage of the disease.

3. Operation when the patient is acutely ill is always serious. This is particularly true, if the operator be unskilled or the surroundings unfavorable.

4. A consideration of the general subject of hæmorrhage, the writings of many operators, and my personal experience lead me to believe that intraabdominal hæmorrhage due to ectopic gestation does not necessarily have as high a mortality as prevalent teaching would indicate.

1. There can be no doubt (*a*) that extrauterine pregnancy is a grave affection, if proper treatment is not promptly instituted. This is abundantly shown by the unrecognized and hence improperly treated cases that go to the coroner. (*b*) Further, all will admit that immediate operation, under elective conditions is safer than the disease, provided it is recognized before rupture or abortion, or before a severe hæmorrhage has reduced the patient's margin of reserve strength. Even if the patient's reserve strength has been materially reduced by hæmorrhage, she may again become a favorable operative risk by a short period of appropriate treatment. Another elective period for operation may thus be reached.

The elective conditions for operation will, in my judgment, invariably include: 1. A patient with a good margin of reserve strength; 2. A competent abdominal operator whose experience with this affection has been both extensive and satisfactory; 3. Skilled assistants and attendants; 4. Appropriate surroundings; 5. Adequate preparation.

2. So much stress has been laid upon the ghastly picture enacted by grave hæmorrhage that relatively few advanced cases go unrecognized to-day.

But why wait until this dangerous period is reached? Could not the disease just as well be recognized early if pictured as accurately, vividly, and persistently as the tragic stage, and always as its inseparable companion picture? Tubal pregnancy is relatively infrequent. It is indeed the exception for one general practitioner, however busy he may be, to see a dozen cases during his entire professional career. His idea of the affection must therefore come to him ready-made. If he believes that ectopic gestation is so grave an affection that immediate operation must always be done or the patient will perish, he will fail to recognize the picture habitually presented in the safe stage of the disease. As a *practical fact*, does the teaching of to-day actually result in early or late diagnosis? This question is eloquently answered by Dr. Philander A. Harris, who shows that in his series, "(*a*) more than 90 per cent of the 130 patients consulted a physician on account of symptoms referable to the pelvis before the tragic stage was reached. . . . "(*g*) Only about 20 per cent of the

[1] Read before the American Gynecological Society, Philadelphia, May 26, 1908.

physicians consulted in the non-tragic stage arrived at a correct presumptive diagnosis."

Dr. Harris has given us a clear cut distinction between the tragic and non-tragic stages of the disease, and has linked them together as companion and contrast pictures. His paper forcefully directs the attention of the profession to the wide difference between the safe and the unsafe periods for the application of well-planned lines of treatment, whether they be immediately surgical, deferred surgical or at times medical alone.

He gives the following as sufficient evidence for presumptive diagnosis:

"When any woman after puberty and before the menopause, who has menstruated regularly and painlessly, goes 4, 5, 6, 8, 10, 15 or 18 days over the time at which menstruation is due, sees blood from the vagina differing in quality, color, quantity or continuance from her usual menstrual flow, and has pains, generally severe in one side of the pelvis or the other, or possibly in the hypogastric region, ectopic gestation may be presumed."

Such a history should invariably lead the medical attendant to seek expert advice.

3. Operation when the patient is acutely ill is always serious. One can scarcely conceive of less favorable conditions for an abdominal operation than surroundings that are bad, equipment meager, preparation crude, the operator inexperienced, the assistants and attendants inadequate and unskilled, and the bloodless patient's margin of reserve strength narrow, as it must be if death is imminent. Fortunately, such conditions do not always obtain, as is shown by the fact that many eminent surgeons, many of them honored members of this society, have habitually done immediate operation with an extremely low mortality. Yet when Dr. Robb, whose work is of such a high order of excellence that he is able to report a series of more than 100 consecutive abdominal sections without mortality, asserts that he can save more patients in a grave condition by deferred operation, it is time for us to pause and seriously consider the wisdom of *teaching* a penknife policy.

An analysis of 575 cases of ectopic gestation taken indiscriminately from the literature of the last five years shows some interesting facts. Of that number, operation was done within 24 hours of rupture 115 times with 26 deaths, or 22.6 per cent mortality. Operation was not done within 24 hours of rupture 461 times with 31 deaths, or 6.7 per cent mortality.

This striking difference in mortality is due to the fact that the cases were not parallel, there being a larger percentage of grave cases where early operation was done.

Seventy-five patients were critically ill at the time of operation within 24 hours with 26 deaths, or 34.6 mortality; whereas 24 patients equally ill were not operated upon within 24 hours, with 7 deaths, or 29.1 per cent mortality.

We thus have a difference of 5 per cent mortality in favor of deferred operation where the exact plan of treatment is not definitely stated. In striking contrast to these results of much of the current teaching, i. e., immediate operation with NO alternative plan of treatment, I would submit five cases reported by Robb, 5 cases reported by Stillwagen, and 17 cases that came under my personal care, all subjected to deferred operation and without mortality. In my cases the evidences of grave illness were clinical and pathologic. The clinical evidences were syncope with air hunger, extreme palor, and a very feeble pulse that exceeded 140 beats per minute for at least 12 hours. The pathologic evidences were a low blood count made at a variable period from 1 day to 6 weeks after rupture; the point of rupture; and the quantity of blood removed at the time of operation. In all, the clinical picture was typical. In all, the quantity of blood removed was sufficient to indicate a severe hæmorrhage, at least a pint and a half being found in each instance, and more than a quart in most of them. In seven cases the rupture occurred within half inch of the uterus. In an eighth I recognized an unruptured interstitial pregnancy and advised immediate operation. The patient did not think she was ill enough for that. Four days later while at market the rupture occurred; later the badly damaged uterus and a three months' fœtus were removed.

In this series of cases the treatment was definite and systematic. Operation was purposely deferred, and, despite the fact that all were desperate cases, not one died either from

the disease or from subsequent operation. We thus have 75 really grave cases taken from the literature with 34.6 per cent mortality from the disease plus immediate operation, and 27 really grave cases by Robb, Stillwager, and myself without mortality from the disease plus deferred operation.

4. *Hæmorrhage.* Because of the extreme importance of this subject, I would once more direct attention to a comparative study of hæmorrhage from this and other sources.

A. Gastric Hæmorrhage. "Immediately fatal cases of gastric hæmorrhage are comparatively rare." Ewald.

"Hæmatemesis rarely proves fatal." Osler.

Mr. Moynihan, referring to hæmorrhage from chronic gastric and duodenal ulcer, groups his cases in four classes as follows:

1. The hæmorrhage is latent or concealed, is always trivial and often inconspicuous.

2. The hæmorrhage is intermittent, but in moderate quantity, occurring spontaneously and with apparent caprice at infrequent intervals. The life of the patient is never in jeopardy from loss of blood, though anæmia is a persistent symptom.

3. The hæmorrhage occurs generally, but not always, after a warning exacerbation of chronic symptoms. It is rapidly repeated, is always abundant, its persistence and excess cause grave peril, and will, if unchecked, be the determining cause of the patient's death.

4. The hæmorrhage is instant, overwhelming, and lethal. (The author says, "In my own experience only one such example has occurred, a large and oval opening being then found in the splenic artery.")

With regard to hæmorrhage from acute ulcer, however, Mr. Moynihan has this to say: "The vomiting of blood comes unexpectedly and suddenly, a large quantity of blood is lost, and the patient suffers, often in an extreme degree, from the symptoms of hæmorrhage. The pulse becomes feeble and fluttering, and the face waxen, the body surface cold and clammy. For a time symptoms may give rise to a serious alarm, but a rally is seldom long delayed.

"The characteristics of hæmorrhage from acute gastric ulcer are, therefore, the marked tendency to spontaneous cessation, the frequency of a repetition of the hæmorrhage in any way but trivial quantity, and transience of the resulting anæmia." B. G. C. Moynihan.

"Cases in which hæmorrhage is so severe as to cause death are rare." Franz Riegel.

"A single hæmorrhage is rarely so profuse as to cause immediate death." Also, "It is exceptional for gastric hæmorrhage to prove immediately fatal." Pepper.

Like opinions are expressed by Pepper, Zeimssen, Thompson, and others.

Recently (1906) Collier has reported 180 consecutive cases of gastric hæmorrhage treated medically without mortality. Commenting upon this observation, Stengel and Edsall say their experience is in strict accord. Russel reports 98 cases of hæmorrhage from gastric ulcer with no known death from hæmorrhage. True, this is not a universal experience, but might it not become so if the same measures were employed with equal skill?

B. Intestinal Hæmorrhage. "In order that a patient finally die as a result of hæmorrhage (typhoid), its repeated occurrence is necessary. Fulminant, rapidly fatal cases are, fortunately, not common. A fatal termination in the course of two or three days is rare, after a repetition of a hæmorrhage." Curschmann.

"Very rarely a patient will bleed to death." Tyson.

In 1,500 cases of typhoid fever treated in my wards, hæmorrhage occurred in 118, with death in 12 cases." (10 per cent.) Osler.

The death rate from recurrent hæmorrhage together with persistence of the original disease (typhoid fever) is variously estimated as from 10 per cent to 44 per cent by such observers as Osler (10 per cent), Tyson, Nothnagel, Liebermeister (38 per cent), Homolle (44 per cent), Greisinger (30 per cent), and others.

C. Pulmonary Hæmorrhage. "Hæmorrhages that occur in the early stage of phthisis may be profuse, but they are rarely dangerous. In advanced stages, it may be the immediate cause of death." Loomis.

"Even in advanced phthisis, patients seldom die from the immediate effect of hæmorrhage." Thompson.

"In phthisis, hæmorrhage may be the direct cause of death, but as a rule the patient survives it." Strumpel.

"Hæmorrhages from the bronchi may be small or large, but even if large and continued for several days, they are seldom fatal." Delafield.

Uterine hæmorrhage occurring in the course of cancer, uterine fibroids, and arteriosclerosis of the uterine vessels may be persistent, repeated, and alarming; but death from a single hæmorrhage is extremely rare. This observation is too common to permit of quoting authorities.

That recovery may take place after the sudden loss of a very considerable quantity of blood is shown by cases recorded by the following authorities:

Gastric Ulcer. A W. Mayo Robson, Case 5, 2 pints, recovery. Case 6, 2 pints, recovery. A. H. Breck, over 6 pints of blood by measurement in 2½ days; recovery. C. B. Keetley, Case 3, some quarts of blood; recovery. E. P. Joslin, hand basin full of blood and repeated on following day; recovery.

Hæmorrhage Complicating Typhoid Fever. W. Coleman, typhoid fever patient lost in one hæmorrhage three to four pints of blood; recovery. J. R. Durham, typhoid fever, three pints fresh blood at one time, in all about 6 pints. B. F. Stahl, typhoid, hæmorrhage, 84 oza.; recovery.

Hæmorrhage, Post-Partum. Edward Reynolds, 2 quarts; recovery. J. M. Sligh, 3 quarts; recovery.

I have personal knowledge of a man who in one afternoon lost three quarts of blood and made a speedy recovery.

It would seem that a sufficient number of recognized authorities have been quoted to sustain the point that primary hæmorrhage from the stomach, intestines, lungs, or uterus may be severe, but rarely proves fatal.

My personal experience leads me to believe that the same is true of intraabdominal hæmorrhage due to tubal pregnancy. In a series of something more than 100 consecutive cases of extrauterine pregnancy seen in almost all phases of the disease, I have not seen one patient bleed to death at the time of rupture, though two have died from hæmorrhage. A seven months' living fœtus was removed from one woman; she bled to death at the time of operation which was done with great skill at a time of choice. One other patient, one of my own, died from hæmorrhage plus immediate operation. The death rate in this series of more than 100 cases was slightly less than 4 per cent, there being four deaths in the entire series that has come under my observation.

Of this series approximately 50 were seen in the capacity of assistant. Fifty-eight were my own cases. In my series there were only 2 deaths, one due to hæmorrhage plus immediate operation and the other to postoperative peritonitis which proved fatal in 30 hours. This woman was young and anxious for children; she insisted that one tube be saved. Her ectopic mass was about the size of an egg. The opposite tube was closed and contained about two drams of fluid. The ectopic mass was removed. The other closed tube was opened. An attempt was made to keep it patulous. It is my belief that the infection was probably due to material from the opposite tube and death might have been averted if both tubes had been removed. This case is reported in detail to show that the ectopic mass probably had no connection whatever with the fatal infection.

4. *Recurrence of Bleeding.* The retching, vomiting, and churning due to fresh blood in the stomach, together with the digestion of clots, afford sufficient reasons for persistent, repeated, and profuse hæmorrhage from gastric ulcer. There is likewise sufficient reason for intestinal hæmorrhage to recur. The contents of the small intestines are normally liquid until they pass the ileocæcal valve. When the blood is poured into the intestinal canal, as from a typhoid fever ulcer, it coagulates and the clots stimulate more excessive peristalsis. This vermicular action may very readily squeeze the clot from the eroded vessel, or the processes of digestion may remove it. Again the vessel gaps and hæmorrhage returns.

So also with pulmonary hæmorrhage. The normal functions are exaggerated and breathing and coughing readily dislodge the clots which afford temporary protection from bleeding.

Vascular changes, traumatism, and periodicity afford adequate cause for repeated uterine hæmorrhages.

In striking contrast to the foregoing condi-

tions in which repeated hæmorrhages would seem the rule, we find bleeding from tubal abortion or a ruptured tubal pregnancy. In this affection there is rarely any involuntary or physiological reason why a blood clot, once formed, should be dislodged or digested. In order for the clot to become detached, some extraneous cause must usually exist, such as exertion, curetting, a vigorous examination, or the disturbance incident to being transported to a hospital.

It is a matter of common observation that a patient with a tubal pregnancy has had a sharp, severe pain in one side and a slight hæmorrhage which apparently ceased. After a few days of confinement to bed she would think herself well or become impatient and resume her usual duties. Following house work, a walk, drive, or other exertion, sudden pain and severe hæmorrhage would occur.

In my 58 cases an occurrence was noted six times as follows:

CASE 1. Mrs. S. had gone a week over her period and consulted her physician because of a sharp, tearing pain in her side. She was given a hypodermic, told to remain in bed and treatment directed. A few days later she got up hurriedly for some purpose, was seized with severe pain and fell over in a faint. I saw her with her family physician, treatment was agreed upon. Weeks later she was sent to hospital and the ectopic debris removed. Convalescence was normal and recovery complete.

CASE 2. Mrs. L. remained in bed eleven days after her first rupture. Contrary to her physician's instructions she got out of bed and walked a mile to attend to some matters of business. While away she had a severe pain, became gravely ill and was carried home. I saw her with her physician about eight hours later. We agreed upon a line of treatment which was carried out. At the end of 10 days she was brought to the hospital; operation was done 20 days later. She recovered completely.

CASE 3. Mrs. R. had her first hæmorrhage when her period was about one week overdue. Her next hæmorrhage occurred about three weeks later. She was a strong woman and the loss of blood was not great. Though the history was typical, her disability was slight, and she continued her usual mode of living. On the day of the last hæmorrhage, she called to see a physician on another floor in the building in which my office is located. She became suddenly ill and was brought up to my office. At that time, she was very weak, pale, and short of breath. Her pulse was between 130 and 140, her temperature 99. While at the office a blood examination showed hæmoglobin, 60 per cent; leucocytes, 11,000; red blood cells, 3,820,000. An ambulance was called and she was taken to the Allegheny General Hospital. She reacted promptly, and was thought to be in good condition for operation 17 days later. At operation, we found a tubal abortion with three distinct clots of different ages, indicating three distinct hæmorrhages. Each of the two more recent sacs contained more than a pint of clots. Her convalescence was uncomplicated. She looked and felt perfectly well when seen three months later.

CASE 4. Mrs. D., who was about 5 days overdue, had her first pain July 4, 1907. The following day she had another and remained in bed a few days, when she was allowed to resume her usual duties. During this time she was continuously losing a small quantity of dark ropey blood. July 19, she jumped quickly from bed, felt a sudden severe pain, fainted, became acutely anæmic and gravely ill. Her family physician asked me to see her with him. Her pulse was still more than 140 and feeble. A good nurse was gotten, treatment begun and in about a week it was thought safe to take her to the Columbia Hospital, though she was not a fit subject for an elective operation. I was preparing to leave the city for a month and the patient expressed a desire to defer operation until my return. Though I felt no apprehension regarding her safety, it was arranged that operation should be done at any time, if it seemed necessary. Early in September, about six weeks from the time of rupture, she was a good subject for elective work. We removed about a quart of blood clot and a tube that was ruptured within less than half an inch from the uterus. Her recovery was prompt and complete.

CASE 5. Mrs. M. was seen with her family physician about 60 miles from the city. She had missed her period and had two attacks of pain, each requiring morphine. After the second she remained in bed a few days. About ten days after the second attack she walked down stairs and became acutely ill. I saw her that night. After about two weeks of rest and tonic treatment carried out by her physician, she was brought to the hospital. Further bleeding occurred as a result of her trip. About ten days later the cul-de-sac was incised and a quart of blood evacuated.

CASE 6. Mrs. K., a young married woman, always regular was overdue a few days when she had severe pain and cast off a membrane, March 23, 1908. She continued to lose a little dark ropey blood almost continuously for a month. There was not the slightest systemic evidence of internal hæmorrhage. During the succeeding five weeks she had four other attacks of severe pain without systemic effect; however, during the greater part of that time she was going up and down five flights of stairs about once a day and the pain usually came after such exercise. At operation we found a few ounces of blood in the pelvis and an unruptured tube, the product of conception having died early and remained at about the junction of the middle and outer thirds.

Not infrequently a mistaken diagnosis of incomplete abortion is made. In some of

these cases the patient is curetted and renewed bleeding brought about. This occurred in four of my cases. One became acutely ill, the other three did not, though their symptoms were aggravated.

Less frequently it happens that a patient who feels that she is pregnant attempts to produce an abortion and precipitates a rupture. In two of my cases the use of a catheter was the exciting cause of a second hæmorrhage, the first having been slight.

Every operator of wide experience can recall cases in which a repetition or at least a marked increase of hæmorrhage followed quickly upon a thorough bimanual examination. My personal observation includes 3 cases as follows:

Mrs. S. was examined at his office by a prominent gynecologist of our city; she felt some pain. That night I saw her at her home, some 25 miles out of town. She was quite sick but not seriously so. She was kept at rest under her family physician and about ten days later taken to the hospital where I assisted the examiner in the evacuation of about a pint of blood clot from the cul-de-sac. Another of my cases has been previously reported; a third lost about four additional ounces of blood as a result of the examination.

There is no doubt in my mind that the exertion, jolting, and other disturbance incident to transporting a patient to a hospital are a very probable cause of continued or repeated bleeding. So firmly am I convinced of this and of the efficacy of rest as the chief factor in checking and preventing recurrent hæmorrhage of this nature, that I have habitually advised at least a week or ten days of delay in sending to the hospital a patient seen some distance away. In three cases, and three only, have I observed a repetition of bleeding due to this cause. One entered the hospital the day of her hæmorrhage and the other two within two or three days of the last preceding hæmorrhage.

One patient, my first case of tubal pregnancy, was seen by her physician at the time of her first pain. He gave her a hypodermic injection of morphine and was again called to see her at a second pain one week later. Her third pain occurred three days later and he was again called. He found her very ill and sent her to the hospital. An intravenous injection of normal salt solution and other stimulation were given. Reaction was not satisfactory. She was operated upon at once. Our patient died on the table. It may be said that a more skilled operator would have saved her life. That may be true, but I justified myself there by the facts that I was acting in accord with the teaching of the day and that I was not wholly unprepared for such work, as I had assisted a gynecologist of unusual skill and good judgment for more than two years. Let me ask how often such a tragedy is enacted throughout this land each year by those of like limited experience because they feel impelled to act promptly and rescue their supposedly perishing patient?

It will be seen that in my own cases the question of recurrent bleeding and its cause, were definitely recorded 21 times. In these 21 cases recurrence was precipitated by extraneous and preventable causes 19 times. In one case, my first ectopic, the patient was stimulated, given an intravenous injection of normal salt solution, and immediate operation was done. The patient died on the table.

In 18 cases the bleeding was completely controlled by appropriate non-surgical measures. They were later operated upon and recovered.

In the two remaining cases bleeding was essentially a part of the disease. In each of these there was a living fœtus which continued to grow and hæmorrhage was recognized by the repetition of slight pain rather than systemic evidences of loss of blood. These patients were in the hospital, in favorable conditions and safe surgical surroundings. Both made a good recovery after operation.

From the foregoing facts relative to hæmorrhage in general, and our own cases of hæmorrhage from ectopic gestation both primary and recurrent, it seems reasonable to conclude that under certain conditions the mortality need not of necessity be high. This applies to those who have reached the tragic stage as well as the less advanced cases.

The treatment which has proven uniformly satisfactory and safe in our hands has been as definite and precise as that demanded for any elective surgical procedure. It should consist essentially in a competent, confident, quick attendant of strong personality, preferably a

thoroughly tested graduate nurse; absolute rest in one position without a single voluntary movement for a period sufficient to permit a firm clot to close the severed vessel. (As indicated by the use of clamps in vaginal hysterectomy, this probably exceeds 48 hours.)

The absolute avoidance of examinations is often desirable. In serious cases the diagnosis can usually be made from the history alone, and in such cases it is most unwise to run the risk of starting fresh bleeding by a vigorous examination. The unnecessary expenditure of energy can be controlled by the use of small doses of morphine during the first few days. Normal temperature is to be kept up by external heat. The volume of blood lost may readily be replaced by a small quantity of normal salt solution, given cautiously into a vein. It may be maintained by continuous enteroclysis, normal salt solution being used at the rate of ten to fifteen ounces an hour. The equilibrium of the circulation may be established by the use of small doses of strychnine, camphor, and digitalis, and by the use of small doses of adrenalic chlorids given with the intravenous injection or with the enteroclysis.

Care and much good judgment must be used to avoid raising blood pressure sufficiently to cause fresh bleeding, though I am inclined to the belief that this danger has been overestimated.

Of my cases 58 were under my personal care from the time of maximum depression. They were seen at my office, or sent directly to the hospital by their medical attendants. Twenty-six patients I saw from time to time with their family physician. Nineteen of the patients had partially recovered before coming to the hospital. Some of these lived a distance from the city. Their physician telephoned me regarding them. These patients did not usually come to the hospital in less than ten days or two weeks, but they all came — and recovered.

CONCLUSIONS

1. Extrauterine pregnancy is always to be looked upon as a serious affection, though not necessarily immediately fatal. In substantiation of that fact, I submit 100 consecutive cases without mortality from hæmorrhage.

2. It usually requires operation. Pending that procedure, the patient should be handled with extreme care.

3. Operation when a patient is acutely ill is always serious. This is particularly true if the operator be unskilled or the surroundings unfavorable.

4. The decision for immediate operation is at times entirely proper, but it should rest upon a low mortality, for such operations in the individual operator's hands, rather than an essentially high mortality the disease has been credited with having.

TRANSACTIONS OF SOCIETIES

THE AMERICAN GYNECOLOGICAL SOCIETY

Thirty-third Annual Meeting, held at Philadelphia, Pa., May 26, 27, and 28, 1908.

The President, Dr. J. Montgomery Baldy, of Philadelphia, in the chair.

The sessions were held in the Assembly hall of the College of Physicians and Surgeons on the first day, and on the second and third days at the Bellevue-Stratford Hotel.

After an address of welcome by Dr. Edward L. Duer, of Philadelphia, which was responded to by Dr. William M. Polk, New York, the reading of papers was proceeded with.

The first order was a symposium on

IMMEDIATE VERSUS DEFERRED OPERATION FOR INTRAABDOMINAL HÆMORRHAGE DUE TO TUPAL PREGNANCY

Dr. Florian Krug, of New York, read the first paper in this symposium.

Dr. F. F. Simpson, of Pittsburg, Pa., read a paper on Deferred Operation for Intraabdominal Hæmorrhage due to Tubal Pregnancy. (See paper, p. 82).

Dr. Hiram N. Vineberg, of New York, followed with a paper on the same subject (see paper, p. 79).

Dr. E. E. Montgomery, of Philadelphia, confined his remarks to the significance of rupture and the general plan of treatment to be employed. He said that the one ever-dreaded termination was that of internal hæmorrhage, which might be slow and small in amount, or so profuse as to threaten life and even cause the death of the patient. Hæmorrhage might occur in one of four ways: 1. It might be the result of rupture of the tube, either into the peritoneal cavity, when it is free and might be excessive, or into the broad ligament and was necessarily limited in quantity; 2. The development of the embryo within the tube so thins its walls that the chorionic villi might project through pinhole perforations and cause dangerous and continuous hæmorrhage; 3. A partial separation of the embryonic sac might occur and hæmorrhage fill the tube, escaping from its abdominal end and through the uterine end into the uterus. In this form the clotting took place early in the tube and the quantity of blood lost was slight; 4. The fœtus and its envelope might be forced through the abdominal end of the tube into the peritoneal cavity — a tubal abortion. This accident was not infrequently associated with very profuse bleeding.

In the four conditions above described, the hæmorrhage might be slight or be very severe. The most active and threatening hæmorrhage was most likely to be associated with the first and second divisions.

In the majority of cases of ectopic gestation, the hæmorrhage, if untreated, would not prove fatal. Very rarely, in the cases formerly supposed to have been cured by the systematic employment of the galvanic or faradic current, was the fœtus alive at the time of the application, the fœtus having already met death through the rupture of the sac.

The symptoms regarded as diagnostic of ectopic gestation were those incident to rupture, as diagnosis prior to rupture was not then regarded as possible. The electrical treatment, consequently, was applied to the pelvic collection of blood resulting from the rupture and the cure consisted in the removal or absorption of the clots. It was doubtful whether the absorption under the treatment was any more expeditious than it would have been had no treatment been employed.

With the shock and diminished arterial tension incident to the rupture of a tubal gestation-sac, the tendency to the formation of a clot, the probability of the arrest of hæmorrhage was increased. In many cases, this arrest occurred before a hæmorrhage of any severity had ensued and the patient so rapidly recovered from the indications of an internal hæmorrhage as to leave the diagnosis in doubt.

The amount of hæmorrhage and its consequent danger would depend somewhat upon the site of the rupture and the existing condition. Rupture of a considerable sized vessel, or over the implantation of the placenta, might produce a hæmorrhage of such gravity as to lead to dissolution before any preparations could be made for an operative procedure. Bleeding from pinhole perforations of the chorionic villi might be so severe as to cause

faintness which recurs with every increase of the vascular tension until the life forces of the patient were completely sapped.

That fatal hæmorrhage does occur from ectopic gestation had been too well demonstrated to admit of denial. The records of the Coroner's physicians of all of our large cities, and the experience of many physicians had abundantly proven this. In such cases prompt action would prove the sheet-anchor. It was just as important that the bleeding tubal vessel should be secured as if a vessel of equal size upon the surface were the cause of the hæmorrhage. It was true that an external hæmorrhage might be controlled by pressure, or hæmostatics, but such treatment would not be considered as good surgery. Under the decreased tension from shock, the bleeding vessels of the ruptured gestation-sac might become occluded by clot and further hæmorrhage arrested, but the surgeon had no assurance that the favorable termination would result in the case under observation. Measures which would ordinarily be employed for rallying the patient from profound shock were reprehensible here, as the only hope for the patient outside of operation was that, with decreased vascular tension, the clotting of blood in the bleeding orifices would become so firm that it would act as an efficient barrier against further hæmorrhage. Intravenous injections of salt solution, heart stimulants, or any measures to improve the circulation were unjustifiable until the bleeding vessel could be secured, as by endangering the displacement of the clot they increased the peril of the patient. For a similar reason, the patient who has had a free internal hæmorrhage should not be subjected to manipulation for diagnostic purposes. In these cases we must rely on the history and the visible physical signs, supplemented, if desired, by blood studies for the diagnosis.

Dr. C. C. Frederick, of Buffalo, said that the necessity for a decision to be made between immediate and deferred operation for intraabdominal hæmorrhage due to tubal pregnancy is quite rare, or has been in the writer's experience, owing to the fact that diagnosis of the existence of ruptured tubal pregnancy by the family physician has been made late, seldom within the first three or four days after primary rupture, and often as many weeks thereafter. Out of about 125 cases of ruptured tubal pregnancy, the writer has seen, in only six cases, the hæmorrhage immediately following rupture was large enough to endanger the life of the individual. Three were in extremis when first seen and were immediately operated upon, meantime, using every possible means of stimulation to tide them over the operation. All died in shock.

Having had such bad results in the first three, he in the fourth case decided to stimulate and wait. She, also, was in extremis, almost pulseless, ten hours after rupture. She did not rally and died three hours after he first saw her. The fifth case was seen about two hours after rupture; patient's pulse was countable at 120; both heart sounds quite clear, but the patient was much shocked. Advised stimulation and normal salt solution subcutaneously. Patient rallied for a time but began to fail in another hour and he, being busy with other work, another surgeon was called in and, at once, operated, saving the woman's life. A sixth case operated upon about five hours after rupture, while suffering much from shock, made a good recovery.

It therefore appears, from his experience, that only about five per cent of ectopic pregnancies are accompanied by a dangerous hæmorrhage at time of rupture. In the remaining 95 per cent, as the result of shock and lowered vascular tension, together with the small size of the vessels torn, the bleeding is normally controlled, at least temporarily, by coagulation. Later, when vascular tension again rises and the patient begins to move about, the hæmorrhage may and generally does recur. The writer has operated two cases in whom hæmorrhages had recurred at frequent intervals, for five or six months respectively, the patients being about the size of normal pregnancy; the mass being composed of concentric layers of coagula. On the other hand, he has seen several patients in whom there was an undoubted rupture of a pregnant tube, with hæmatoma in the pelvis, in whom hæmorrhage did not recur and who were not operated and made perfect recoveries. The author has operated upon, at least, four women who had chronic pelvic lesions, following a clear history of unoperated former ruptured tubal pregnancy, in whom the remains of the ectopic gestation were found, some of them several years following the accident. All of these facts go to show that a very small percentage of ruptured tubal pregnancies is immediately dangerous to life from hæmorrhage.

But, the question still remains, when we are brought face to face with a rupture, is this one of the 95 per cent which will be self-limited, or is it one of the five which will kill the woman? The condition is much like acute appendicitis, we never know at the beginning what is going to happen.

Theoretically, we may consider these cases scientifically by making an examination of the hæmoglobin index frequently and determine if the hæmorrhage is progressive, at the same time having repeated counts made of the red blood cells to determine if they are diminishing progressively.

These procedures are not practicable under the condition ordinarily encountered at the time these patients are seen. Theoretically, we ought to be able to determine accurately if bleeding is continuing, but, practically, we are not able to do so. It has always seemed to the writer that bleeding, whenever endangering a patient's life, if it can be controlled, should be controlled. It is a surgical principle from which it is difficult to get away. It, therefore, has always appealed to the writer to be good principle to open the abdomen in these cases as soon as seen, using all possible known means of stimulation during the operation, that is, if the patient's condition is one of danger; otherwise, if the patient does not show profound shock from hæmorrhage, he should advise waiting till they rally.

It would seem, considering the results he had following immediate operation, that it was the wrong thing to do. He, however, believed that they all would have died if they had not been operated upon when he saw them. Undoubtedly, the large proportion of cases of rupture will do better if allowed to wait till bleeding ceases spontaneously; but he feels that there is a small percentage of instances, when the bleeding vessel is so large that spontaneous control is impossible, and in these immediate operation is the only chance to save the patient's life. We, therefore, are forced to the conclusion that no definite rule can be laid down for all cases. Each must be judged of according to the conditions present, remembering that there are 95 chances of the hæmorrhage ceasing to about 5 of its going on to a fatal termination.

But we must not wait in these few cases till there is no vitality left upon which to depend during operation.

Dr. Egbert H. Grandin, of New York, read a paper in this symposium (see paper, p. 27).

THE TIME TO OPERATE IN INTRAABDOMINAL HÆMORRHAGE DUE TO TUBAL PREGNANCY

Dr. Walter P. Manton, of Detroit, Michigan, said that not many years ago the dictum went forth that all cases of appendicitis must be operated upon as soon as the diagnosis was made. Riper experience and a closer analysis of cases and results had modified these views so that to-day no surgeon of experience would for a moment think of following so restricted a rule of practice.

In attempting to answer the question as to the time to operate in ruptured tubal pregnancy, we are confronted by a proposition somewhat analogous to that which occupied the attention of surgeons concerning appendicitis in the earlier days; the essential difference being that the former had been recognized and described during nearly a century and a half, while the latter had been known for hardly more than two decades. Our knowledge of tubal pregnancy has been one of slow growth and the evolution of surgical technique has been more gradual. Lawson Tait, who did more than any modern operator to direct attention to the dangers of ectopic gestation, declared that he had "never seen an intraperitoneal hæmatocele that was not due to ruptured tubal pregnancy," but Werth and a host of others have shown that tubal abortion is a much more frequent cause of the blood escape than rupture of the tube. The conditions given by Antoine Petit in the latter half of the eighteenth century as pathognomonic of tubal gestation are no longer considered worthy of attention, while the classical symptoms laid down for guidance in the text-books of only a few years ago have had to be largely overhauled, modified, and corrected in present-day literature. Atypical symptoms of misplaced conception are at present so frequently registered that, while certain manifestations may be taken as of positive evidence, the general and special expressions of the condition are often so obscure as to mislead even the most acute. Surgical intervention is not infrequently attempted too late, and the operation has to bear the onus of untoward results, or abdominal section gives the only means of arriving at a correct diagnosis. All of this goes to show that our knowledge of the symptomatology of tubal pregnancy is constantly changing and enlarging. With all the shifting diagnostic presentations, however, the original advice as to the method of treatment remains practically unchanged. It has been repeatedly pointed out that there are five stages of ruptured ectopic pregnancy in which the physician sees the patient and decides on the course of treatment to be pursued:

1. The so-called fulminating cases in which the blood is poured out from lacerated vessels, the result of rupture of the tube or complete expulsion of the ovum from the ostium abdominale. These cases are associated with the evidences of large blood loss, preceded or accompanied by more or less severe pain, pallor, small thready pulse, profound shock, and physical collapse.

2. Cases in which repeated attacks of pain are felt in the lower abdomen together with faintness, possibly vomiting, and more or less shock and prostration, but in which the blood loss at any one time is slight — a condition which has been aptly described as "tubal drip." Such manifestations are not infrequently met with in partial rupture of the tube, or partial tubal abortion.

3. Cases in which rupture of the tube has taken

place and a hæmatocele has been walled off from the general peritoneal cavity.

4. Old cases in which the effused blood has been wholly or partially absorbed, leaving behind the products of conception surrounded by a more or less distinctly defined exudate.

5. Cases in which the products of conception having escaped from the tube continue to develop.

In the first instance, it seems to him that there can be no reasonable question as to the proper method of procedure — the method recommended by Goupil more than fifty years ago, viz., "stop the hæmorrhage." In the best interests of the patient, therefore, the immediate operation is demanded in these cases.

It is well enough to say that, if left alone, the bleeding will cease of itself, and deferred operation can then be undertaken under more favorable circumstances. In many cases this is true, but it is not true in all, and the anatomical arrangements are not favorable to such desirable termination. Recent advances in our knowledge of the implantation of the ovum have thrown much light on this important point. The not infrequent records of cases in which the unfortunate woman has bled to death should deter from procrastination in this tragic event. Those who claim that death rarely takes place under the conditions mentioned should study the cases reported before the operative treatment of extrauterine pregnancy was inaugurated. Goupil, from a large experience both before and after death in this condition, concluded that "all cases of intraperitoneal hæmorrhage arising from extrauterine pregnancy end in death." Parry gives the mortality under these conditions as about 68 per cent, with probably 53 per cent due to rupture. Presumably the ectopic gestation of to-day originates in the same way and follows the same course, or would if let alone, as it did in 1848. If these observations are considered antiquated and doubt still exists, reference to current medical literature will show yearly a sufficient number of fatalities from intraperitoneal hæmorrhage incident to tubal rupture or complete tubal abortion to convince, it would seem, the most sceptical. In recent years many more deaths would probably have taken place but for the prompt and timely intervention of surgery; and the mortality following operation is steadily decreasing in the hands of the best operators under improved technique.

Are we justified, then, in assuming the responsibility of advising expectant treatment in these cases in the face of such threatening, grave dangers? The writer thinks not.

In the second class of cases, where the amount of blood is often small, but the extravasations are repeated, unless the patient can be kept under the most careful surveillance the sooner operation is undertaken the better. While it cannot be denied that the surgical procedure may often be deferred with possible safety to the patient, it is also certain that no one is in position to determine when a serious or even fatal hæmorrhage may supervene, so that the sooner the dangerous and offending part is removed the better for the patient.

To sum up. In determining the course to pursue in the treatment of intraperitoneal hæmorrhage due to tubal pregnancy, a rare judgment fortified by experience is demanded. While no golden rule will lead the surgeon to success, accumulated experience demonstrates that if there is free blood in the peritoneal cavity and hæmorrhage going on, the sooner operation is undertaken the larger are the chances for rescuing the patient. It is literally true in the management of this calamity that "The man that wandereth out of the way of understanding shall remain in the congregation of the dead."

Dr. A. Lapthorn Smith, of Montreal, said that there is only one treatment for tubal pregnancy, and that is early removal. If rupture has taken place, the case becomes an emergency one. Even if the patient is unconscious from shock (hæmorrhage), he would not wait until she rallied, for this will mean a fresh hæmorrhage, but he advises cutting down and tying the bleeding vessel, replacing the blood that is lost with normal salt solution.

Dr. B. F. Baer, of Philadelphia, said it is always imperative to act at once, secure and close an open, bleeding vessel, and this holds true in hæmorrhage from a ruptured tubal pregnancy. But there may be a doubt in a certain case of very profound collapse whether the vessel is still open and whether it might not be wise to spend a few hours in restorative measures.

Dr. August Martin, of Berlin, said there is no necessity for operating on these cases hastily if hæmorrhage has ceased, but if bleeding is still going on, we should follow the surgical rule to operate with a view to stopping the hæmorrhage. As to whether the operation shall be done at the residence of the patient or not depends on circumstances, but preferably the surgery shoud be done at a hospital. If the case is urgent, operation should be done immediately and by the abdominal route, but in less severe cases the vaginal route can be selected.

Dr. Seth C. Gordon, of Portland, Maine, quoted the dictum of Lawson Tait that "no man living ever made a diagnosis of extrauterine pregnancy before rupture." In 1887, a pupil of the speaker telegraphed him to the effect that he had a case of extrauterine pregnancy and desired Dr. Gor-

don to be ready to come to see the patient at a moment's notice. Two hours later rupture took place, but it was twelve hours after rupture had taken place before the speaker saw the patient. After opening the abdomen he removed four quarts of bloody fluid and a fœtus, which was about ten or twelve weeks old. The woman made a good recovery. He mentioned three other cases he had operated on after rupture had taken place, with recovery of all the women. He recalled only two cases in which he was able to make a diagnosis before the occurrence of rupture, and these were operated on promptly, and both women recovered.

DR. H. J. BOLDT, of New York, said that whether an operation for intraperitoneal hæmorrhage from ectopic pregnancy should be deferred or be undertaken immediately must depend upon the judgment of the individual physician, based on his personal experience and also on a careful study of the experience of others. He premised his remarks with a statement of what he meant by a primary hæmorrhage from ectopic gestation and what by a secondary intraperitoneal hæmorrhage. He said to assume that a tubal pregnancy patient showed no noticeable symptoms of the faulty impregnation until suddenly an excessive tubal rupture occurred which caused complete collapse, evidenced by absence of the pulse at the radial arteries, with the other signs of a sudden and profuse loss of blood. The shock might be so severe as to cause absolute unconsciousness. That was what he called a primary hæmorrhage.

Assume another patient with ectopic gestation, who had experienced the symptoms that usually accompanied a typical case of tubal abortion, or of partial tubal rupture, with the symptoms of an intraperitoneal hæmorrhage. She was not in collapse, however, although her pulse might be very small and rapid, and her appearance that of acute anæmia. Her mental faculties were perfect, or so nearly so that she might give the physician intelligent answers to his questions. She improved with rest, and after a day or two her general condition improved materially. Then another attack came on, which caused collapse as the result of the intraperitoneal hæmorrhage. The collapse was not, however, caused by the primary hæmorrhage, but by the secondary bleeding.

An analysis of the cases in which there was profound collapse from intraperitoneal hæmorrhage, but in which nothing in the history pointed to previous intraperitoneal bleeding, showed that by far the greater majority rally from the bleeding sufficiently to come well out of the shock.

To operate upon a patient in profound collapse from a primary hæmorrhage was, in his opinion, a mistake; because, with proper treatment, the patient might rally in the course of a few hours. While it is a fact that some patients did not rally sufficiently to be operated upon in their improved condition, we might be able to judge of this during the interval from the first sight of the patient to the time when she was prepared for the operation. His own experience had been that in such patients bleeding was renewed within a few days, or even sooner. In waiting for an improvement in the condition of the patient we must remember that a betterment of the pulse quality also brought increased blood pressure and the danger of renewed intraperitoneal hæmorrhage. An operation should not be deferred in patients with active symptoms of partial tubal rupture or tubal abortion. The sooner the operation the better.

If the general condition of the patient evidences a slight betterment, we should not operate then, but wait until the patient had more fully recovered, if this seemed likely. The fact that the surgeon, assistants, and nurses, with all the other requirements, were in readiness, was no excuse for jeopardizing the chances of the patient by operating too soon; since the added shock of the operation, no matter how rapidly or dexterously done, did not lessen the chances of a favorable outcome. It was more rational to wait for three hours or more until the patient's condition had improved so markedly, judging from the pulse, respiration, condition of the skin, and mental condition, that a rapid operation could be done with comparative safety. No time should be lost in looking for the embryo, or in washing out the abdomen. Get out the readily accessible clots and dip the bulk of blood out rapidly with the hand, leaving the rest; pour into the abdomen a pitcherful of saline solution, leaving it to be absorbed with the blood that has been left. In such cases no "fancy work," such as implanting the ovary in the uterine cornu, is permissible. Rush the work without bungling. Such procedure should also be employed when improvement in cases of primary hæmorrhage did not take place.

His preference was not to transport such patients to the hospital, but to operate upon them in their homes, because of the increased danger caused by the transportation. How long should the operation be postponed if a patient did rally? Not at all, if she had really rallied, when she had a fair pulse, was perfectly intelligent in her answers, and had a normal skin. To wait longer was to assume risks for her, which we had no moral right to do. Were there cases of intraperitoneal hæmorrhage in which operation might be deferred, or might

be entirely omitted? This question could be answered in the affirmative.

Should symptoms occur at any time that led us to believe that intraperitoneal bleeding was renewed, we must no longer delay operation, because with a patient in favorable condition the mortality from operation was very low, perhaps less than 5 per cent.

DR. E. W. CUSHING, of Boston, said his attention was called to this subject some twenty years ago by a case in a near relative. Those who are old enough would recall many cases of so-called hæmatocele which got well, and he doubted whether women have tubal pregnancy any oftener to-day than they did in 1888. Notwithstanding this, he believes in operating on these cases, and yet he has seen several patients whose symptoms of tubal pregnancy, with or without rupture, were so slight and so obscure that it was not easy to obtain consent to operate. He mentioned two cases upon which he had operated within two months, the operations having been followed by the recovery of both patients.

DR. HUNTER ROBB, of Cleveland, said that more conservatism in the treatment of ectopic pregnancy is called for in the majority of cases. When the diagnosis of ectopic pregnancy is certain, operative measures are indicated; but in most cases the danger is not sufficiently imminent to warrant immediate interference, unless the condition of the patient is otherwise satisfactory. Many women not only survive the effects of a tubal abortion or rupture, but also recover, even without an operation. Not more than 5 per cent of the victims of ectopic pregnancy die at the time of rupture, whereas after the immediate operation in cases of ectopic gestation in 1,176 cases in twenty-five clinics the mortality was 8 per cent. When a patient is seen in a state of collapse as the result of a ruptured ectopic sac, she should not be operated on until the condition of shock has been tided over. These patients when they die, usually succumb not from loss of blood, but mainly from shock. Why, then, should we superadd to the original shock the additional shock of a major operation, with all the exhausting preliminary procedures? In support of the view that these patients die from shock and not from loss of blood, we have clinical observations of good authorities, and also experiments on animals, the first showing that patients whose abdomens were filled with bloody fluid survived; and the second proving that dogs, when exposed to dangers from hæmorrhage sufficiently severe to more than equalize the factor of resistance, do not succumb. In most of these cases, when we operate to ligate a bleeding vessel, no bleeding vessel is found. In some cases the bleeding is undoubtedly started again by the manipulations of the operators. What frequently appears to be a continuing hæmorrhage may be produced by a welling up of the blood that was poured out when the sac finally escaped through the fimbriated end of the tube. Some of the reasons why the hæmorrhage is not so great as has been generally supposed at the time of rupture are: 1. The great majority of ectopic sacs rupture between the first and third week of gestation; 2. The point at which the impregnation takes place is a small area, formed by a diverticulum in the tube, and the chorionic villi have only a feeble attachment; 3. Seventy-five to 78 per cent of the ruptures occur through the fimbriated end of the tube and are tubal abortions, and not more dangerous, so far as hæmorrhage is concerned, than those occurring through the cervix; 4. The next most frequent place of rupture is the isthmic portion of the tube which is also free from any large blood-vessel; 5. The point of rupture in the gestation-sac practically never involves the ovarian or uterine artery; 6. As a result of the inflammation which precedes the ectopic gestation, there is a relative increase of the connective tissue in the tube, and, owing to the contraction of the connective tissue, the vascularity of the tube is limited; 7. The placenta is generally attached to the posterior wall of the tube, and, as the rupture is generally through the anterior or lateral wall of the tube, the placenta is not lacerated, but retains a firm attachment to the wall of the tube and is subjected to pressure.

Physiologists teach that a woman weighing 130 pounds must probably lose four pounds of blood before succumbing to the effects of the hæmorrhage *per se*. So large an amount of blood is rarely found in the abdominal cavity; the bloody fluid is a mixture of blood and a serous exudate. The sudden removal of a large quantity of recently accumulated fluid in the abdomen before the other vessels have had time to adapt themselves to the altered mechanical conditions is dangerous and may be followed by fatal syncope. Patients in whose cases the bleeding would be sufficient to cause death are rarely seen in time to be saved by an operation for ligating the bleeding vessel. The best operators give a percentage of 40 or 50 as their death rate after immediate operations during shock. The deferred operation has given better results in the hands of equally good operators. So long as there is a reasonable evidence that immediate operation may be the wrong procedure, it is the duty of the physician to hold his hand and leave something to nature.

DR. J. WESLEY BOVEE, of Washington, D. C.,

said there can be no doubt but that, if some cases of tubal pregnancy are allowed to go without operation, the patients will die from a subsequent hæmorrhage. No case is safe without operation. He prefers the abdominal to the vaginal route. If the case is very urgent, the surgical work should be correspondingly rapidly done. There is no indication, in his opinion, for vaginal section in cases of ectopic pregnancy.

Dr. Andrew F. Currier, of New York, agrees with those who have spoken that these cases are surgical, and just as a surgeon will endeavor to stop a hæmorrhage that occurs from a bleeding vessel in any portion of the body, so it is equally important and proper to stop it in cases of tubal pregnancy. He thinks it takes a very acute sense to know when bleeding in these cases has actually ceased, and if one is satisfied that there has been bleeding, he did not see any good reason for delay in operating, except in those cases in which the symptoms are mild and in which it is possible to bring the patient under more favorable circumstances for operation, but if hæmorrhage has occurred the woman should be treated in a surgical manner.

Dr. Hugo Ehrenfest, of St. Louis, said he operated on a woman a few weeks ago in whom infection had occurred from a well-formed hæmatocele from an attempt to perform a criminal abortion on herself. She was three months advanced in pregnancy. A diagnosis of infected hæmatocele was made from the presence of a mass and septic fever. Operation confirmed diagnosis.

Dr. F. Pfannenstiel, of Germany, said there are a few rare cases in which hæmorrhage is so great that they must be operated on promptly in order to save the lives of the patients. He thinks we should operate as early as possible without precipitation.

Dr. Brooks H. Wells, of New York, said that, while in cases of ectopic pregnancy 95 per cent may get well without operation, and that 5 per cent will surely die without being operated on, the best results can be obtained by operation done just as soon as the diagnosis can be made. Those women who make the quickest and smoothest convalescence, and who have the fewest symptoms of trouble afterwards, are the ones who are operated on promptly. Furthermore, the mortality rate in those operated on quickly is much smaller than in those that have been in "cold-storage" for days or sometimes weeks.

Dr. Joseph Taber Johnson, of Washington, D. C., said it is a backward step to wait and see whether these patients are going to bleed again or not. The proper thing to do in these cases of emergency surgery, provided a skillful operator is at hand and the surroundings are good, is to operate; and the sooner the ruptured tube is removed the better. Even should hæmatocele form, there is no assurance that it may not become infected.

Dr. William Gardner, of Montreal, believes that the majority of cases should be operated on, but the question arises should the gynecologist wait or not in the face of the symptoms presented or operate immediately. He thinks Professor Pfannenstiel sounded the keynote when he said we may operate but without precipitation. He would wait in certain cases, but watch them carefully, before deciding to operate.

THE HEART IN SHOCK

Dr. Eugene Boise, of Grand Rapids, Michigan, said that the most generally accepted theory as to the pathology of shock was that in which Dr. George W. Crile was the most recent and most pronounced advocate, namely, that shock was an exhaustion of the vasomotor center.

The author also referred to the theories of Howell, Henderson, and others in regard to shock.

He mentioned the testimony of Porter and others that long-continued stimulation of afferent nerves did not cause low blood pressure through exhaustion of the vasomotor center.

He said Henderson also found the heart in rapidly fatal cases of shock, small, contracted, and hard. The same condition prevailed in a less degree in cases less rapidly fatal.

Experiments that he had made at the laboratory of Parke, Davis & Co. confirmed him in this view. Dogs and rabbits were used. Nearly all were anæsthetized by chloretone introduced into the stomach, thus giving an even and reliable anæsthesia. Artificial respiration was used. In several it was almost impossible to induce shock, because, as he now knew, carbon dioxide was allowed to accumulate in the blood through imperfect respiration. The kymograph gave the pressure tracings by means of canula inserted into the carotid. The myocardiograph was attached to the walls of the right ventricle. Veratrone, which is a preparation of veratrum viride, made by Parke Davis & Co. for hypodermic use, was used to counteract the shock and to lessen the tachycardia and raise the blood pressure.

His experiments showed: 1. That whatever may be the effect on the vasomotor center, the impulses of stimulation from the injured peripheral nerves are transmitted to the heart by its augmentor nerves (through the stellate ganglia) causing increased ventricular contraction, and that the rise in blood pressure was consequent upon this heart action, largely if not wholly. 2. That when, by

reason of long-continued stimulation of efferent nerves, the animal is in a condition of shock, the amplitude of the heart beat was much diminished and the diminution was entirely because of very incomplete ventricular relaxation, a condition that may justly be called tonic or tetanoid contraction. 3. That veratrone, which causes, when given to a normal animal, decided fall of pressure, given in a condition of partial or complete shock, would cause a *rise* of blood pressure, but to do this must be given in doses much larger than the ordinary dose. This action of veratrone goes far to disprove the theory of vasomotor exhaustion.

The combined testimony of Crile's experiments, as narrated in his work on Surgical Shock, of Henderson's experiments with carbon dioxide, and of his own, pointed almost conclusively to cardiac spasm as the true pathology of shock. Assuming this to be correct, the treatment must be directed to the relief of this condition. Crile attempts it by mechanical compression and by adrenalin. Henderson says that it is easily accomplished by increasing the amount of CO_2 in the blood. And that he himself had sought the remedy among the cardiac relaxants or inhibitors, and had found that veratrum, while it is not the ideal remedy, will accomplish the desired result.

All this was concerning traumatic or surgical shock, uncomplicated by any considerable loss of blood. Whether the pathology of the many conditions that have been called shock was the same, he did not know. There was room for exact experimental work in differentiating these various conditions. Neither the collapse of hæmorrhage nor that which occurs at the height of acute infectious diseases, nor that condition which follows septic peritonitis, or perforation of an intestine, were to be properly called shock. But the pathology of mental, traumatic, or surgical shock was, he believed, cardiac spasm, excessive fullness of all the veins of the body (somatic and splanchnic), and comparative emptiness of the arteries. If this condition be due entirely to a diminished amount of CO_2 in the blood, then, as Henderson says, the one method of treatment was to increase the CO_2 which certainly simplifies the treatment of this condition. If we sought to relieve shock by cardiac relaxants, they must be given in very large doses. For this reason veratrone was almost contraindicated. Some other relaxant must be sought, possibly aconitine or berberine.

PERNICIOUS ANÆMIA AND PREGNANCY

DR. PALMER FINDLEY, of Omaha, Nebraska, read a paper on this subject in which he detailed the following case:

He said the patient was referred by Dr. Jones, of Griswold, Iowa, as a pregnancy combined with suspected pernicious anæmia. Her age was 42 years. She had been married ten years and had borne six children. No abortions. No history of excessive loss of blood or infection as the result of previous pregnancies. At the time of her admission to the hospital, May 14, 1907, she was in the 30th week of gestation. Early in pregnancy she began to feel weak. She rapidly grew weaker and paler as the pregnancy progressed, but pursued her house work until six weeks before her admission to the hospital. Her appetite was fair and there were no unusual subjective symptoms other than that of weakness. Nothing in the family history having a possible bearing upon the case. Because of the critical condition of the patient only this meager history was obtainable.

Examination by Dr. Dunn, of Omaha, was as follows: General appearance: Patient is a well-developed woman apparently 35 to 40 years of age. There appears to be no emaciation. The skin is of a faded, lemon yellow hue. There are no petechiæ or subcutaneous hæmorrhages. Patient is remarkably dyspnœic, orthnopnœic, and but little cyanotic. Pulse rapid, 110. Blood pressure 143 r. r. (5 cm. band). She wanders and is slightly delirious.

The heart is a little enlarged, especially to the right of the sternum. A systolic murmur is to be heard all over the precordium — it is soft and blowing in character, and loudest in the mitral area. There are no accentuations of any of the sounds; except for some moist râles at the bases of the lungs, there are no pulmonary findings.

Abdomen: The liver is somewhat enlarged and tender, especially in the epigastrium. On deep inspiration the edge can be felt two to three fingers' depth below the costal arch in the nipple line; spleen not palpable. There are the findings of between a seven and an eight months' pregnancy. There are no fœtal heart sounds. There is slight retromalleolar and tibial œdema. Tenderness over sternum and tibia.

She was admitted to the hospital May 14, 1907, at 6 P. M. No fœtal heart sounds were heard and no fœtal movements were detected, At 7 o'clock on the following morning she was delivered spontaneously and with no pain. While not aware of the birth, she told the nurse she had soiled the bed and on inspection the nurse found the dead baby and placenta lying upon the bed. There was very little blood lost. The blood pressure an hour after delivery dropped from 143 to 88 when she became comatose and died at 8:30 A. M.

The post-mortem findings were a large amount

of lemon-colored fat in the abdominal wall, the skeletal muscles showed fatty changes as did the heart, liver, kidneys, and uterus. There was atrophy of the stomach and intestinal mucosæ and the characteristic bone findings.

Blood examination of mother:

Reds, 672,000; hæmoglobin, 16, Dare 20, Talquist Index, 1.2; differential nucleated cells; polymorphonuclear neutrophiles, 60.; myelocytes 11; eosinophiles 0; lymphocytes, 15; large mononuclear, 1; normoblasts, 2; megaloblasts, 7; mastzellen, 4.

Karyokinetic figures present in reds in considerable numbers.

Polychromatosis and poikilocytosis marked.

Bone marrow shows megaloblastic hæmatogenesis.

Blood examination of babe:

A count was made of some fluid blood found in the right ventricle of the infant about three hours after birth:

Reds, 3,720,000; hæmoglobin, 1.08 Dare; polychromatosis plus; poikilocytosis plus. Nucleated reds in large numbers. An occasional megaloblast is to be seen.

There were no characteristic findings of pernicious anæmia in the babe.

As the result of his observations, he presented the following summary: 1. Pregnancy and the puerperium exercise a favorable influence on the development of pernicious anæmia. 2. Women are more liable to pernicious anæmia during pregnancy and the puerperium than at any other time. 3. There is no satisfactory explanation for the effect of pregnancy upon the development of pernicious anæmia. Frequent child-bearing, prolonged lactation, overwork, and malnutrition are predisposing factors. 4. There is a remarkable uniformity in the clinical phenomena and post-mortem findings. 5. The onset of anæmia is usually in the latter half of pregnancy. 6. The diagnosis is not possible at the onset, but is later determined by exclusion of other possible forms of anæmia by blood examination, fatal termination, and finally by post-mortem examination. 7. The child usually dies in utero or shortly after birth and has never been observed to show pernicious anæmia. Spontaneous interruption of pregnancy is the rule. 8. In all well-established cases the disease has proved fatal.

DISCUSSION

Dr. Richard C. Norris, of Philadelphia, has seen only one case of pernicious anæmia in over 3,000 consecutive deliveries. This woman entered the hospital a few days before she was delivered, with only 12 per cent hæmoglobin. A characteristic of labor was a refusal of the patient's blood to clot. There was considerable oozing from the uterine cavity which persisted so as to require intra-uterine packing and the use of adrenalin to control hæmorrhage. The woman, however, finally died from this persistent oozing from the uterine cavity.

SUGGESTIONS IN TEACHING GYNECOLOGY

Dr. John A. Sampson of Albany, New York, demonstrated mechanical charts as an aid in this work and said that three phases in the study of any of the clinical branches of medicine naturally suggested themselves. First, the study of each disease as a science, namely, its cause, the changes in anatomy in its different stages, and, particularly important, the explanation of its symptomatology. Second, the classification of symptoms and the study of the various causes of each symptom and how these causes may be differentiated. Third, the art or technique of the clinical branch of medicine, namely, taking of the history, physical examination, diagnosis, and treatment and the importance of clinical experience on the part of the student in the dispensaries, wards, and hospitals or in private practice. The conditions caused by each disease, which are illustrated problems, the student should attempt to solve from his knowledge of normal anatomy, normal physiology, etc., instead of memorizing data obtained from lectures or text-books. In the solution of these problems questions are asked and the answers of the student corrected when necessary and supplemented by information which he cannot be expected to reason out.. Various means may be employed, such as drawings, models, actual specimens removed at operations or at post-mortem examinations, using whichever means are best adapted to the special subject under consideration. Mechanical charts are of great value in this work.

HOSPITAL GYNECOLOGY

Dr. Robert C. Dickinson, of Brooklyn, New York, spoke of gynecology as a separate department, and described the character of hospitals as affecting this. He spoke of the working adjustments between surgery and gynecology and of the relations between assistants and house staff. He believes that there should be uniformity in technique where the operators are numerous, and thinks there should be also standard schedules of preparation, of outfit, of after-care. He spoke of the methods of exhibiting or guarding the histories of cases in wards, and also discussed the question of files, indexing, the interrelation of hospital and dispensary.

THE SURGICAL TREATMENT OF PROLAPSE OF THE UTERUS AND BLADDER

DR. I. S. STONE, of Washington, D. C., read a paper on this subject in which he spoke of the treatment of cystocele by flap-splitting. The elevation of the bladder after its separation from the vagina or uterus or both — the lappenspaltung of Sänger. Uterovaginal fixation applied to the treatment of prolapse of the bladder, with or without associated prolapse of the uterus.

In 1899, the author read a paper in which he reported his experience with what he believed to be a new method of treating cystocele. After varying success with the former methods, he was prompted to apply a modification of the Mackenrodt vaginofixation operation, and obtained absolutely perfect results so far as cystocele was concerned. The application of vaginofixation was borrowed or adapted from Mackenrodt, but not so with the division of the anterior vaginal wall and the separation of the bladder from it. This was entirely original, as at that time he had not read Sänger's publications. The greater ease with which vaginal hysterectomy could be performed and the possibility of excising the upper part of the infected vagina in carcinoma of the cervix, gave him the opportunity of observing how easily one could separate the vaginal wall without injury to the bladder. To show that Sänger's or Mackenrodt's methods were not known or generally recognized in America, it is only necessary to say that he read three papers in as many gynecological societies in different cities of this country, without being reminded by any of those present or taking part in the discussions, that he was using as his own what was rightfully claimed by others, notably the great Sänger.

The operation is most useful in those neglected cases of prolapse occurring in women who have borne many children, or who are near or after the middle period of life. His experience now covers fully ten years, during which time he has fifty cases, nearly all of which have been two years or over without recurrence of the cystocele. Besides the class of cases above mentioned, the older women, he absolutely relies upon the Sänger method for the child-bearing women who have need for plastic surgery. As previously stated, he has seen no recurrence of cystocele after the complete operation. But this does not mean that one should expect the uterus to remain *in situ* if it has been prolapsed, unless additional and appropriate measures have been taken to secure the organ in its correct position. Prolapse of the uterus is always a result of ligamentary deficiency and is usually associated with a descent of the viscera, including the peritoneal supports above and behind the organ. Therefore, in his opinion, all cystoceles, when associated with prolapse of the uterus, should have some one of the reliable operations which afford a firm and enduring fixation of the uterus, the choice being an abdominal musculomuscular (scarified fundus uteri or rectus) approximation. Only in exceptional instances has he found it necessary to amputate the portio vaginalis.

The development of the operation, its numerous modifications as performed in various countries, and its results, have been duly set forth, notably by the German gynecologists. One of the most important of these papers was contributed by Professor A. Martin, of Greifswald, whose exhaustive paper was read at the Würzburg congress in 1903. The credit of first performance of the flap-splitting operation as applied to the cure of cystocele belongs to Sänger. Older writers may have made suggestions and incidentally have performed similar work, but when the great gynecologist of Leipzig exploited the method, all of his associates appeared to be anxious to apply it in appropriate instances. About the time that Sänger began to use the method, Arx, of Basle, also tried and approved of it with some modifications. Sänger divided the anterior vaginal wall in the median line, and was satisfied to separate the bladder from it, without carrying the dissection as far as most surgeons have thought best. He found that the contraction of the cicatricial tissue in the scar appeared to draw the cervix forward and downward. Arx performed a more radical operation and added amputation of the cervix. Arx was most generous in according to Germany what Sänger had claimed for him (Arx). In one of the papers by Arx (written in 1906), he credits Gersuny with an independent performance of the operation. Gersuny also thought himself a discoverer, and was finally corrected by Sänger. Gersuny proceeds exactly as Sänger to complete the separation of the bladder from the anterior vaginal wall. Then he applies what is recognized as the "Stolz" method, which he uses in turning in ("einstulpung") the base of the bladder. Two or more layers or tiers of purse-string sutures invert the cystocele into the bladder. After this inversion, he excises the long flaps and unites the vaginal wall edge to edge as usual.

Mackenrodt not only has the honor of the invention of the vaginofixation operation for retroversion of the uterus, but has reported his method of treating prolapse of the bladder, which is similar to it. His first paper appeared in 1893. Schauta was also among the very first to adopt the method.

His first paper was contributed in 1899, but he claims to have perfomed the operation for ten years previously. His method is best suited to the extremely bad prolapses of older women and he is entitled to the invention of the so-called "interposition" operation. He occasionally amputates the cervix uteri and always elevates the bladder upon the uterus after making a free separation and liberation of the entire base of the bladder. He opens up the space between the bladder and uterus as far as the vesicouterine fold but stops there, and hence the uterus is secured to the anterior vaginal wall much as in the Mackenrodt-Steinbuchel-Lott operation.

Dührssen first reported his work in 1901, having used the operation before that time — as early as 1894. His method is very like that of Schauta, and is in reality an "interposition" operation. He gives Schücking credit for the suggestion that vaginofixation would cure prolapse. Freund, Fritsch, and Wertheim not only separate the uterus from the bladder but actually draw the uterus into the vagina and there suture it permanently.

The French surgeons have not adopted this operation very generally, but the author finds that a number of them have used it, among others Laroyenne, Abeau, Villa, Delbet, Delanglade, Pozzi, Quènu, and Jacobs (Belgium).

In America the teachings of Sims and Emmet have held firmly in popular favor until a comparatively recent period. Hadra believes the production of a cystocele depended upon a detachment of the vagina from the cervix uteri. His idea appeared to involve a fixation, or normal position for the uterus while the bladder descended with the vagina, which in turn left no protruding portio. His method was not that of bladder separation, but merely to reattach the vagina to the cervix. The author's individual experience with cystoceles of the kind mentioned by Hadra would indicate the almost complete atrophy of the uterus instead of a stripping down of the vagina from the cervix. However, Hadra's method attracted Sänger's attention, although he may not have frequently used it. Winter and many others have made use of similar means of supporting the bladder from the vaginal side. These methods do not, strictly speaking, come under the definition outlined at the beginning of this paper, for these writers do not make a separation of the bladder from either vagina or uterus. In 1899, Watkins reported a method of treating uterine and bladder prolapse, and the author has always thought him entitled to whatever credit may be due to American operators for originality and priority. He preceded the writer a short time in the publication of his paper (November 1899), and although his method was different, both were reaching after the same ideal. Watkins sutured the excised vagina to the broad ligaments and fundus uteri. This necessitated a detachment of the bladder (although he does not mention this) both from the vagina and uterus. He has since modified his technique and has made additional contributions to the literature of the subject. Alexandroff, Tweedy, and Reynolds have reported operations for elevation of the cervix and base of the bladder, by influencing the broad ligaments near the cervix. The last-named surgeon aims to accomplish this elevation by less dangerous or simpler means and does not open the cul-de-sac nor detach the bladder from either vagina or uterus.

ENDOMETRITIS EXFOLIATIVA

DR. HUGO EHRENFEST, of St. Louis, Missouri, contributed a paper with this title.

SECOND REPORT ON OPERATIONS FOR RELIEF OF PELVIC DISEASES OF INSANE WOMEN, INCLUDING 411 PATIENTS

DR. LEROY BROUN, of New York, said that in 1902 he was placed in charge of the gynecological operations of the Manhattan State Hospital, an asylum having under its care some 2,500 women and receiving yearly about 1,000 new patients. All patients on admission were given a systematic physical examination, including the condition of the abdominal and pelvic organs, each feature of the examination being carefully carried out by one trained in the special line.

When pelvic or abdominal pathological conditions were present, such patients were referred to him for the purpose of determining whether symptoms arose from such, and if so whether an operation would be of benefit. The advisability of an operation having been decided on, the guardians of such patients were communicated with, the condition and physical benefits explained and their approval of the operation considered advisable was asked. When refused, as not infrequently, nothing was done. Since his connection with the hospital there had been done by himself and under his supervision 411 abdominal and pelvic operations.

In 1905, he presented for consideration a paper entitled "Operations for Relief of Pelvic Diseases of Insane Women," based on the surgical work performed on these unfortunates during the two years previous. The conclusions drawn were: That in no instance was the mental disturbance of the patients accentuated by the operations performed; that the physical benefit shown by those operated on was noticeable in a marked degree in almost

50 per cent of the cases, and appreciable in about 40 per cent. As a result of this bodily improvement, they became happier and more contented units of the colony among whom they lived.

The mental recovery of 20 of those included in this preliminary report was unquestionably hastened by the operation performed upon them. While in most instances there had been some mental improvement before the operation, yet in all of the 20 the psychic improvement was striking after the surgical recovery, and in some instances the improvement seemed to date from the operation.

Three years have passed since the preliminary report of this work. The number of patients included in the present report is 411. This includes the total number operated on for the last five years. Of this number, 72 patients have been discharged as recovered. The mental recovery of 32 of this number, or about 44 per cent, showed a much more rapid improvement after the operation than before. No patient is included in this number whose mental progress was not strikingly marked after the operation in comparison with her progress before the operation.

For the purpose of studying the character of surgical work done on those whose mental recovery was in a large measure due to the relief given, he had divided the operations into two classes, abdominal and plastic. Among the abdominal operations occurred twelve recoveries; three followed supravaginal hysterectomies for fibromyoma of the uterus, both adnexa being removed in each instance; seven followed suspension of the uterus, in two of which the adnexa on one side were removed; in one gastroplication was also done; in two small fibromyoma were also removed; one followed removal of an ovarian cyst; one followed Bassini's operation for inguinal hernia.

Among the plastic operations 20 recoveries occurred, including operations for endometritis, for lacerated cervix and perineum, and for displaced uteri.

From the above, it would not appear that the mental benefit resulting could be ascribed to any especial class of surgical procedure. Among the abdominal operations the largest number of those benefited were patients with adherent displaced uteri. In none of these were both adnexa removed. In two of these patients one of the adnexa was removed.

Among the total number of abdominal sections it was necessary to remove both adnexa in 37 patients. In only three of these was there any apparent marked mental improvement following the operation. This result is not in accord with the published results of some operators. These operators appear to attach considerable importance to diseased ovaries and their removal, even though slightly cystic, in order to attain the greatest good with their insane patients, the apparent idea being that a certain reflex irritation was set up by the presence of ovaries that were diseased, even to so slight a state as cystic degeneration.

Of the thirty-two patients whose mental recoveries were hastened by the operations twenty-five, or 78 per cent, were in cases in which the insanity showed the dominating symptom of depression. In the old classification existing in the hospital prior to 1904, these were grouped under melancholia, acute and chronic, involution melancholia and depressive hallucinosis. In the new classification now adopted the majority of such conditions are placed under one head, maniac-depressive insanity, and others to the involution period of life. Five of the remainder, or 15 per cent, were patients in an excited or exalted mental state. The remaining two patients were with a diagnosis of dementia praecox and paranoic symptoms.

Fifty-eight per cent of the number of patients who received hospital treatment and operations within six months after the commencement of their insanity, were improved or recovered; 33 per cent of those receiving treatment and operations within a year improved or recovered. These do not include those in the first class; 26 per cent of those receiving treatment and operations after the expiration of a year were improved or recovered. The number of recoveries taking place among those with whom treatment was commenced within six months after the commencement of the mental disturbances was five times as great as among those when treatment was commenced at a later date; 44 per cent of the 72 who were discharged recovered had their improvement hastened by the operations performed. Why was it that some recovered and others with a like mental disturbance, even under the most advanced treatment, failed to respond, can only be answered by citing a parallel with physical diseases. The ability to improve varies with each individual, whether mental or physical. Tomlinson, of the St. Peter's Hospital, Minnesota, aptly expressed this varying response to the stimulus of treatment in the term "individual nervous potentiality."

The view at present accepted by most writers on insanity and by those in charge of large bodies of insane, was that pelvic and abdominal diseases in women act (by the distress following such) as coincident or secondary causes in the production of insanity in women of an already weakened mentality.

In the light of modern knowledge, insanity following surgical operations was rare. The character of the operation is not a factor, such occurrences being as likely to follow a trivial general surgical procedure as one of a graver nature. The determining cause was a neuropathic state associated with an hereditary predisposition and an exaggerated fear of the operation.

With this knowledge, how important it at once became that any woman on becoming insane should be given a thorough physical examination and that all pathological conditions should be rectified at once in order to restore to her at the earliest possible moment a full quota of bodily health, that further treatment could be effective, knowing that the possibility of a recovery diminishes rapidly in the direct ratio of the length of time of the existence of the alienation. If the combined efforts of the alienist and the surgeon should fail, they still had the satisfaction of knowing that the unfortunate patient had been placed in a condition free from bodily discomfort and that she had given to her the same privilege granted when needed to the sister who had been more fortunate.

SYMPOSIUM: INTRAPELVIC (SUBPUBIC) VERSUS ABDOMINAL METHOD OF DEALING WITH MECHANICAL OBSTRUCTION TO DELIVERY IN CASES OF CONFINEMENT

DR. RICHARD C. NORRIS, of Philadelphia, said that the modern result of elective section justified the extension of the limit of the absolute indication. He pointed out what this limit should be and spoke of the degrees of relative disproportion which existed and which furnished debatable ground. He referred to the factors to be studied before or during labor that promised spontaneous delivery or safe operative assistance. The actual test of labor should not be abandoned. He spoke of the methods and value of fœtometry, of pelvimetry, and of studies to determine the character of membranes, of cervix and of uterine energy. The status and methods of induction of premature labor for minor degrees of relative disproportion were described and personal statistics given. He spoke of the value and limitation of forceps and version. He referred to the circumstances which justified section of the pubic bone. Pubiotomy was preferable to symphyseotomy. The accidents of pubiotomy were best avoided by the most approved technique and by skilled operative delivery which included complete preliminary dilatation of birth canal.

DR. EDWARD REYNOLDS, of Boston, said that: 1. In the absence of mechanical difficulties, intrapelvic methods were always preferable. 2. Throughout obstetrics a low maternal mortality was the most important of all considerations, and this should determine the choice whenever it was markedly variable as between the two methods. 3. Comparison of maternal mortalities under differing conditions. 4. Similar comparison of fœtal mortalities, and maternal and fœtal morbidities when maternal mortalities were equal. 5. Difficult cases in which the necessity for some form of operative procedure could be safely predicted in advance should be submitted to primary Cæsarean section. 6. Limitations of the possibility of such prediction.

DR. EGBERT H. GRANDIN, of New York, said that under relative indications the operation of election in hospital practice was the elective Cæsarean section by the abdomen. Careful consideration of these instances from every standpoint showed that such section, other things being equal, carried less risk to the woman and better subserved — certainly as well, as alternate operations.

DR. BARTON COOKE HIRST, of Philadelphia, made a plea for conservatism in restoring Cæsarean section. A large number of these operations are only justifiable in clinics to which the patients are transported without previous medical observation. The indication of labor two or four weeks before term obviated the necessity for the majority of Cæsarean sections and should be resorted to more frequently.

DR. A. LAPTHORN SMITH, of Montreal, said that the operation of Cæsarean section has been so perfected that, when performed by an experienced abdominal surgeon, it had now hardly any higher death rate for mother and child than normal labor. This could not be said of prolonged application of forceps nor of even the best of the subpubic methods.

THE PRESIDENT'S ADDRESS

PRESIDENT BALDY, in his Address discussed the general policies, advances, and failures of the past, and the duties of the future. (See paper, p. 21.)

THE DEVELOPMENT OF THE TECHNIQUE OF GYNECOLOGICAL OPERATIONS.

DR. AUGUST MARTIN, of Berlin, Germany, presented a review of the work done by gynecologists in the past fifty years, and said the basis of the increasing value of gynecological operations is the advance in anatomy, normal and pathological, and in diagnosis. Asepsis insures surgical results. He said there are two routes in the front of discussions to-day, the abdominal and the vaginal, and he described the indications and limitations of each.

ABDOMINAL AND VAGINAL CŒLIOTOMY FOR GYNECOLOGICAL OPERATIONS; THEIR INDICATIONS AND TECHNIQUE

DR. F. PFANNENSTIEL, of Kiel, Germany, followed with a paper on this subject in which he pointed out that either method is available for the majority of gynecological operations. The route which gives primarily and secondarily the best chances of life and health for the patient is to be preferred. In all intraperitoneal procedures the best chances are given by abdominal cœliotomy, as it affords the better opportunity for either radical or conservative work. In aseptic cases, tumors, extrauterine pregnancy, chronic inflammations, malformations, etc., the abdominal route is preferable. In septic cases, when the indications are that the infectious matter can be completely removed, the vaginal route is preferred, unless a complete view of the whole operative field and its surroundings is necessary. Except in early invasion of the cervix, all cases of cancer are better treated by the abdominal route; also when involvement of the appendix is suspected. Vaginal operation accomplished most in all cases of prolapsus or descensus (genitoptosis) and movable retrouterine displacements. Here neither suspension nor the Alexander operation with or without colporrhaphy is permanent. Anterior and posterior vaginal cœliotomy are used, sometimes the one, sometimes the other, and, if necessary, both.

The author then pointed out the advantages of the Pfannenstiel transverse abdominal incision.

VERTICAL AND HORIZONTAL AMPUTATION OF THE UTERUS

DR. HOWARD A. KELLY, of Baltimore, said that supravaginal hysterectomy in women under forty is too radical, if it can be avoided. He spoke of subsection of the body of the uterus as being a better plan, retaining the uterine mucosa, cutting the flow down to normal and preserving the function of menstruation. He then described the methods of vertical and horizontal subsection of the uterus.

VENTROSUSPENSION AN UNSAFE OPERATION FOR POSTERIOR DISPLACEMENT OF THE UTERUS DURING THE CHILD-BEARING AGE

DR. EDWIN B. CRAGIN, of New York, read this paper which will be published in this journal.

IS PUBIOTOMY A JUSTIFIABLE OPERATION?

DR. J. WHITRIDGE WILLIAMS, of Baltimore, stated that in 13 operations performed by the author or his assistants there were no maternal deaths, only one woman being seriously sick. All began to walk by the end of the third week and were dismissed in good condition less than one week later. In one third of the cases there was permanent mobility between the cut ends of the bone. This did not interfere with locomotion, and possibly played a part in permitting subsequent spontaneous delivery in one patient. The operation is contraindicated when the conjugata vera measures 7 cm. or less, and consequently does not enter into competition with Cæsarean section, except that the uppermost limit of the classical indication. It is particularly applicable to the "border line" cases, as it affords a safe method of delivery after subjecting the patient to the test of several hours in the second stage, whereas the mortality of Cæsarean section rises steadily with each hour elapsing after the test of labor. If pubiotomy fulfills its present promise, it should entirely do away with the induction of premature labor in the treatment of contraction pelves.

PRESSURE CONDITIONS WITHIN THE ABDOMEN

DR. RICHARD R. SMITH, of Grand Rapids, Michigan, read a paper on this subject in which he speaks of the importance and desirability of greater accuracy in the application of principles and the knowledge that has been obtained. Obstacles attending experimental work are great, but all real advance in the subject has been obtained only in this way. He then describes the conditions in the abdomen with which we have to deal.

The following paper was also read: "The Condition of the Mucosa in Cases of Uterine Myomata," by Dr. Thomas Cullen, of Baltimore.

OFFICERS ELECTED

The following officers were elected for the ensuing year:

President, Dr. J. Riddle Goffe, of New York.

First Vice-President, Dr. Howard A. Kelly, of Baltimore.

Second Vice-President, Dr. Malcomb McLean, of New York.

Treasurer, Dr. J. Wesley Bovee, of Washington, D. C.

Secretary, Dr. Leroy Broun, of New York.

Members of the Council, Dr. George Tucker Harrison and Dr. J. Montgomery Baldy, Philadelphia.

New York was selected as the place for holding the next annual meeting.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

JOHN B. MURPHY, M. D.
FREDERIC A. BESLEY, M. D.
WM. C. DANFORTH, M. D.
AIMÉ PAUL HEINECK, M. D
E. WYLLYS ANDREWS, M. D.
WM. R. CUBBINS, M. D.
M. G. SEELIG, M. D.
GEO. E. BEILBY, M. D.

OPERATIVE TREATMENT FOR SPINA BIFIDA. By Robert W. Lovett, M. D., of Boston.

Dr. Lovett reports twenty-four cases of spina bifida and draws conclusions from these and other papers where a large number of cases are reported.

The incision should be made in healthy skin when possible, the sac opened and any nerves that may be visible should be reduced into the spinal canal. It is important to close the wound firmly so that there cannot be any leakage. The tumor is most often found in the lumbar region, although it occurred in the cervical region twice in this series.

The contraindications are: Hydrocephalus, other marked deformities, or extensive paralysis. The indications are due to the fact that 90 per cent die during the first years of life without operation — so that there is nothing to lose. The primary mortality is about 35 per cent and the later, 1 to 8 years, about 65 per cent. For this reason it is better to operate early. Some operations were performed immediately after birth, where the sac had been ruptured; these recovered. — *American Journal of Orthopedic Surgery*, October, 1907.

WM. R. CUBBINS.

INTESTINAL ACTINOMYCOSIS. By Lepoutre.

Intestinal actinomycosis is no doubt more frequent than we believe. The affection is not well known and is often overlooked. In one of the cases reported, the diagnosis had been malignant neoplasm. A laparotomy was performed. It gave incomplete results, the patient died. After death, an histological examination of the specimens of the tissues showed that the condition was actinomycosis.

In another case, reported by the author, the diagnosis of tumor had also been made. An operation was performed, actinomycotic bodies were found, the cavity was drained under the influence of iodid of potassium, the patient showed improvement. Death took place, however, seven months later.

Etiology of intestinal actinomycosis is variable. It may be due to animal origin, but the contagium is more frequently conveyed by vegetables on which the parasites live. Grains or straw are not the only incriminating bodies. The parasites may be found upon fruit, upon vegetables, upon salads. Intestinal actinomycosis is much less frequent than actinomycosis of the head or of the neck. In 600 cases of actinomycosis the intestines were involved but 80 times.

At the period of onset the diagnosis is extremely difficult. It becomes less difficult when fistulæ form, through which fairly characteristic fluid escapes. Potassium iodid given in large doses has, at times, a positive action upon this disease. Medical and surgical treatment can with advantage be combined.

From the prognostic standpoint, Devan in 1902, collected 84 cases of abdominal actinomycosis of intestinal origin. In this series there are 23 cures, 10 improvements and 51 deaths. When the liver is involved, the mortality is 100 per cent.— *Actinomycose intestinale. J. des Sc. médicales, Lille, 1907.*

AIMÉ PAUL HEINECK.

SOME OF THE REASONS WHY CHOLECYSTECTOMY SHOULD NOT BE PERFORMED AS FREQUENTLY AS IS ADVOCATED BY MANY SURGEONS. By John B. Deaver, M. D.

The writer first considers the physiology of the gall-bladder, and states that, while he is well aware that patients who have had their gall-bladders removed may remain perfectly well, he believes that this does not demonstrate that the gall-bladder has no useful purpose. "From the standpoint of subsequent pathology, the gall-bladder is surely a most useful organ by way of which to drain in certain septic conditions of liver and

biliary passages." The author's indications for cholecystectomy are:

1. Hydrops of gall-bladder with obliteration of cystic duct.
2. New growths of gall-bladder.
3. Chronic empyema — acute empyema drainage may suffice.
4. Gangrene of gall-bladder.
5. Perforation of gall-bladder.
6. Where many small stones are imbedded in mucous membrane and cannot be removed.

He closes by stating that hard and fast rules cannot be established, and that from what he can read and hear he fears that removal of the gall-bladder is done too frequently.— *The American Journal of the Medical Sciences*, April, 1908.

CHOLESTERIN IN BILE, AND ITS SIGNIFICANCE IN THE FORMATION OF GALL-STONES. By Dr. Bachmeister.

By numerous chemical experiments, Bachmeister shows that cholesterin is a constituent of bile itself, and that it is neither directly nor indirectly furnished by the lining epithelium of the gall-bladder. Before making this statement, he carefully considers all evidence to the contrary, and then furnishes a full page tabulation of his own data. He furthermore shows that if pure, sterile, filtered bile is allowed to stand for a long time, cholesterin will be precipitated out of it. This precipitation he believes to be due to a complicated chemical change that occurs in the bile as a result of long stagnation. He demonstrates that, if protoplasm of some sort, particularly epithelial cells, be added to bile, the cholesterin is precipitated much more rapidly than it would be otherwise, and on this fact he bases his contention that the epithelial lining of the gall-bladder in this indirect manner serves to hasten or increase precipitation. — *Münch Med. Woch.*, February 18, 1908.

M. G. SEELIG.

PERFORATION OF THE GALL-BLADDER DURING TYPHOID FEVER: CHOLECYSTECTOMY: RECOVERY. By Astley Paston Cooper Ashhurst, M. D.

Two new cases are reported. The first was operated upon with a diagnosis of intestinal perforation, the rupture having occurred on the thirty-second day of the disease. The rupture of gall-bladder was not discovered at operation. Patient died.

In the second case, the perforation occurred on the forty-second day. A diagnosis of ruptured gall-bladder was made. Operation revealed a collection of pus above transverse colon and walled off by adhesions. The gall-bladder was found to have a ragged perforation, measuring 1¼ x 1½ inches. It was removed and tubal and gauze drainage instituted. Patient recovered. Cultures showed a pure growth of typhoid bacilli.

In both patients there was a rapid fall of several degrees in temperature immediately following the perforation. Tables are given of the cases collected from the literature and show a mortality of 61.90 per cent.— *The American Journal of the Medical Sciences*, April, 1908.

ILEOCÆCAL INVAGINATION. ITS ANATOMICAL CONDITION. By René Leriche et Cavaillon.

Two facts are prominent in ileocæcal invagination: 1. The insignificance of the causes which produce it. 2. Its occurrence chiefly in nurslings. Having these two clinical facts in mind, it was natural to suppose that this ileocæcal telescoping was due to anatomical dispositions existing in early life. The cæcum is free in the early periods of fœtal life. It fixes itself progressively. It is only after birth that it loses its mobility. Anatomical research shows that 48 per cent of fœtuses have a completely free cæcum; on the contrary 83 per cent of adults have a cæcum which is solidly fixed to the iliac fossa. It is not astonishing, therefore, that ileocæcal invagination which demands that the cæcum be mobile, should occur with much greater frequency in early childhood. Adults are few in whom the cæcum is mobile enough to produce this displacement.— *Invagination iléo-cæcale—Ses conditions anatomiques. Semaine Méd.* 20 février, 1907.

SURGICAL TREATMENT OF CHRONIC INTESTINAL INVAGINATION. By L. Gernez.

In the early part of his article, the author discusses the various therapeutic methods employed in these cases. Insufflations and injections are dangerous and useless. Disinvagination should and must be attempted, but one must be careful not to pull upon the invaginated loop. Delbet says the invaginated loop must be unrolled by expression. Once that has been obtained the invaginated loop must be examined and resected, if it be in bad condition. Enteroanastomosis is not sufficient. It does not modify the septicity of the invaginated loop, and the newly-created opening may be obstructed by the progression of the invagination. Resection remains the method of choice. It totally suppresses the invagination and allows a perfect restoration of the continuity and of the caliber of the intestine. Invagination of the upper portions of the small intestine that go as far up as the duodenal-jejunal angle may be treated by unilateral exclusion of the invag-

inated loop and duodenal jejunostomy. Circulation of the intestinal contents is re-established, the invaginated loop is in the most favorable condition for its elimination. Invaginations of the small intestines are almost always due to a pedunculated tumor, and can easily be reduced. If they be irreducible, an extensive resection of the small intestine may be called for. Ileocæcal and ileocolic invaginations are partially reducible. Irreducibility is frequently due to adhesions, to œdema in the invaginated loop, which is constricted by Bauhin's valve.

To avoid recurrence after reduction, the cæcum can be sutured to the parietal peritoneum, or the mesentery may be folded upon itself, or the ileocæcal angle may be resected. Partial or total invagination of the appendix will be treated as an ileocæcal invagination. Colo-colic invaginations are treated by intrarectal resections or by the abdominoperineal method of Quénu, if they be situated upon the pelvic colon. Higher up, bilateral exclusion with suture of the excluded loop to the skin is good treatment.— *Traitement chirurgical de l'invagination intestinale chronique. Archives générales de Chirurgie.* 25 janvier, 1908. AIMÉ PAUL HEINECK.

TRAUMATIC LACERATIONS OF THE MESENTERY. By A. Labastie.

In the study of contusions of the abdomen, the authors have insisted upon visceral lesions, the importance of which is well known, but the effects of contusions of the abdomen upon the intestinal ligaments, upon the mesocolon and the mesentery, have not been much studied.

The intestinal arteries that are injured in lacerations of the mesentery are the superior and inferior mesenteric arteries or their branches.

The disposition of the branches of the superior mesentery is interesting. These branches from 12 to 20, are long above, shorter below. They bifurcate so as to form two or three concentric arcades which approach little by little the border of the intestine. The last of these arcades furnishes the vessels of the intestines. The last branches are true terminal arteries. From this anatomical study, we note that a wound of the secondary branch of the superior mesentery far from the intestine, does not, owing to the richness of the anastomosis, cause gangrene of the intestine; but if the branches are cut or injured near the intestines, gangrene will follow. Here are some of the results of the experiments: Section of the superior mesenteric artery; gangrene of a long portion of the small intestine; section 8 centimetres in length, along the border of the mesentery in such a way that all the recti vessels are divided close to the intestine; gangrene of the intestine for 4 centimetres; incision of the mesentery, 5 centimetres from the mesenteric border of the intestine; placque of superficial gangrene of the intestine; incision, 8 centimetres from the mesenteric border of the intestine; intestine is not involved. The closer these lesions are to the intestine, the more serious are their consequences.

These anatomical and physiological notions have their importance in therapeutics; in fact, early death from hæmorrhage is inevitable if one does not intervene surgically. If, perchance, patient should survive this hæmorrhage, he soon would be exposed to gangrene of the intestine and to peritonitis. Hence, early laparotomy is indicated in these cases. Every time the tear is located near the intestine an enterectomy of the corresponding intestinal zone is indicated. If it is parallel to the axis of the mesentery and at some distance from the mesenteric border of the gut, simple ligation of the vessel will suffice. Further, one can fix an omental graft upon the intestine so as to assure collateral circulation.

If the wound be at the root of the mesentery, a large enterectomy and a partial resection of the mesentery is indicated. A diligent search must be made for visceral lesions and hæmatomata. — *Les déchirures traumatiques du mésentère. Archives générales de Chirurgie.* 25 janvier, 1908. AIMÉ PAUL HEINECK.

INJURIES OF THE VAGUS NERVE, AND THEIR RESULTS. By A. Reich.

Reich lays great stress upon the importance of distinguishing between complete section of the vagus, and those injuries which merely irritate it, without causing symptoms of paralysis. Simple vagotomy in itself is practically harmless, and causes no symptoms referable to circulatory, respiratory, or digestive apparatus, except perhaps, a temporary tachycardia, and slowing of respiration. Death has never been caused by vagotomy. Traumatic irritation of the vagus, however, is a serious matter, inducing most serious symptoms, such as cardiac and respiratory inhibition. The serious nature of these symptoms varies in proportion to the severity of the trauma, the length of its duration, and the disposition or tendency of the patient; a very acute trauma may lead to instantaneous death. These symptoms are caused by reflex excitation of the cardiac and respiratory inhibitory center in the medulla, or by direct stimulation of the centrifugal fibers that run to the heart. The respiratory symptoms are never due to reflex spasm of the glottis.

These symptoms may be guarded against by cocainizing the vagus when one is working in its vicinity, and is liable to injure it. If, however, symptoms of irritation have already been set in action before cocainization, and they cannot be stopped, it is then vitally indicated to do a deliberate vagotomy. This seems, on the face of it, to be a radical recommendation; but, as a matter of fact, animal experimentation proves it to be rational.— *Beit. z. Klin. Chir.*, b. lvi, h. 3.

M. G. SEELIG.

TYPHOID SPINE. REPORT OF A CASE WITH RADIOGRAPHIC EVIDENCE OF STRUCTURAL CHANGE. ANALYSIS OF THE REPORTED CASES — COMPLETE BIBILOGRAPHY. David Silver, M. D., Pittsburg.

This case shows a left lateral deformity and a kyphosis of the first lumbar vertebra with thickening to the left side where the most symptoms were exhibited. The intervertebral substance between the first and second lumbar vertebra is absorbed and the bones united by osseus union. In the paper the analysis of all the reported cases shows average age, 27 years.

History. Trauma present, 27 per cent; onset overwhelmingly present during convalescence. Temperature, always present, varies from 100 to 103; is usually irregular in type; duration varies. Pain in back at location of trouble is always present, onset of variable character. Referred pain to different points present, 54 per cent.

Lesion located most frequently in lumbar region, 83 per cent.

Sensory and motor changes were noted in 25 per cent of cases.

Widal test was made in 14 cases, present in all except paratyphoid cases. Duration averaged about 8 months.

In the treatment, immobilization seems to afford best results; this is obtained by either plaster-bed and plaster jacket, or by braces.— *The American Journal of Orthopedic Surgery*, October, 1907.

WM. R. CUBBINS.

THE SURGICAL SIGNIFICANCE OF ICTERUS. By Amsperger.

This article is based upon 96 cases of icterus, studied at Czerny's clinic. These cases were studied chiefly from the surgical-diagnostic and surgical-prognostic standpoint.

There are cases of icterus, not due to mechanical obstruction to the outflow of bile, but due to some defect in the function of the hepatic cells. This form of icterus may be primary, or may succeed a primary icterus. In these cases the prognosis of surgical intervention is very unfavorable. The presence of urobilin in the urine is evidence of functional insufficiency of the hepatic cells. The presence of bilirubin in the urine speaks in favor of mechanical icterus. A morphological and an hæmoglobinometric examination of the blood, cholemimetry, the degree of alcalinity of the blood, cryoscopy of the blood and of the urine belong to the domain of the specialists, and furnish important prognostic data.

There are no absolute means of recognizing the gravity of icterus. Examinations of the blood, of the urine, and clinical examinations furnish data for the prognosis. The gravity of an icterus is not parallel with its duration, and, nor with its intensity. It depends more upon the vigor and upon the resistance of the organism against the resorbed biliary toxins. In cases where gall-stones are present in the deep biliary ducts, choledochotomy, with drainage of the hepatic ducts, is the ordinary therapeutic method employed. In infection of the biliary passages, depending upon the nature of the infection, the gall-bladder will be either extirpated, or suspended or drained. Cases in which calculi are present in the common duct, and in which icterus is absent, are far more frequent than was admitted formerly. Early operation is indicated in all cases of gall-stone occlusion of the common duct.— *La Signification Chirurgical de l'ictère. Archives générales de Chirurgie*, Dec., 1907.

AIMÉ PAUL HEINECK.

VESICULO-BRONCHIAL FISTULA; LAPAROTOMY. RECOVERY. By Klauber.

Patient who had been suffering for some time from gall-bladder colic, suddenly began to spit up very large quantities of a frothy bile-stained sputum. Owing to the presence of this symptom, it was decided to operate, and a cholecystectomy was performed. Recovery was spontaneous though no bile escaped externally. The bile, and the stone which was removed by operation, did not occlude the common duct. Nevertheless its removal left the common duct so free, that the bile easily resumed its normal path of outlet. The author has collected from the medical literature the similar cases that he was able to find. He thinks that he should have performed a cholecystectomy in his case.— *Fistule vesiculo-bronchique; laparatomie; guérison. Archives générales de Chirurgie*, December, 25, 1907.

DIAGNOSIS AND TREATMENT OF ACUTE PANCREATITIS. By L. Lafosse.

Acute pancreatitis is not an uncommon affection. Diagnosis is not often made because we do not

think of the pancreas. Clinical diagnosis is easy enough, whether we deal with acute hæmorrhagic pancreatitis, or acute suppurative pancreatitis. The presence of a pancreatic syndrome is suggestive of the condition. This syndrome is: *a*. sudden onset, *b*. celiac pain, *c*. hyperacute cachexia, *d*. local tumefaction. The evolution of acute pancreatitis occurs in several stages. At the onset the affection is essentially abdominal, then the pus collects and seeks for itself an outlet, either towards superior abdominal space, and gives rise to pleuropulmonary symptoms, this is the thoracic type of the disease; or towards the anterior wall of the abdomen, this is the abdominal type; or towards the lumbar fossae, this is the lumbar type. For the diagnosis of this condition, we have to depend upon the clinical symptoms and upon the clinical examination. Examination of the fæces for pancreatic secretion is as yet of far too recent employment to allow posititive deductions.

There is as yet no method of choice to gain access to pancreatic collections. The type of the pancreatitis determines the method of approach; for the thoracic type, the pleuroperitoneal route will be employed; for the lumbar type, the lumbar route; for the abdominal type, an infraumbilical laparotomy.— *Diagnostic et Trâitement des pancréatites aigues. Archives générales de Chirurgie*, 1907.

Typhoid Spine with Especial Reference to the Deformity. T. Halstead Meyers, M. D., New York.

Dr. Meyers reports two cases of typhoid spine in which a marked deformity was present in both. In one a kyphosis was present at second lumbar vertebra; in the other it was present at the eleventh dorsal. The skiagrams showed that the intervertebral substance was absent between the vertebræ involved in the kyphotic angle. Bodies of the vertebra normal. A view of the literature is also presented.— *The American Journal of Orthopedic Surgery*, October, 1907.

Wm. R. Cubbins.

Appendicitis in the Old. By Ch. Gand.

In the old, appendicitis has aspects that are not found in the young. The appendix of the old shows a marked atrophy, characterized chiefly by the disappearance of the lymphoid follicles. The author limits his study to those cases that have necessitated a surgical intervention, and recognizes two anatomical varieties. In one, pus is absent, and the appendix is in the midst of adhesions, and is transformed into a resistant mass; the appendix shows here only lesions of a sclerosing character. In the other variety, there exists a pus collection; the low seat of the appendix is usually noted, and the tendency to diffusion of the suppurative process is less marked than ordinarily.

Senile appendicitis shows the following characteristics: The onset is insidious; digestive disturbances, such as constipation and loss of appetite, are present. Locally, there appears in the right iliac region a hard mass, dull on percussion, uninfluenced by respiratory movements. Peritoneal reaction is of slight intensity. The temperature is not always increased. These patients progressively become cachectic, either until operation secures the evacuation of the pus, or until the latter creates for itself an outlet, either externally, or into some of the neighboring viscera, intestine, bladder, etc. A torpid form of diffuse aperitonitis may develop.

The symptoms, not being clean-cut, diagnosis is at times difficult. Ileocæcal peritonitis, tuberculous pericæcal peritonitis, are not uncommon in the old. It is important to exclude cancer of the cæcum. At times diagnosis is established only by operation. The prognosis of senile appendicitis must be guarded. Nevertheless, care can be expected after incision and drainage of a well circumscribed suppurative focus.—*The Revue de Gynécologie et de Chirurgie Abdominale*, December, 1907.

Technique of Pancreatectomy. By Desjardins.

The author discusses partial pancreatectomy, especially pancreatectomy of the head of the organ. Owing to the adhesions, existing between the pancreas and the duodenum, and owing to common blood-supply of both of these organs, it is essential that duodenotomy be performed at the same time. After having studied the dangerous zones, the ablation of the pancreatic head, the process of repair, the accidents secondary to the operation, Desjardins gives the following operating technique for pancreatectomy in one step:

After having used Kehr's bayonet-shaped incision, the operator lifts up the omentum and exposes the duodenal peritoneum which he incises and separates as far as possible. Two clamps upon the pylorus, two upon the duodenal-jejunal junction isolate the duodenum; one clamp upon the body of the pancreas permits the liberation of the head of the pancreas. The whole mass is removed in one piece, being careful not to injure the superomesenteric vessels. The repair of the lesions is the next and the longest step in the intervention. We must first do a gastrojejunal anastomosis with the Murphy button, then a choledochojejunal anastomosis with Boari's button.

As to the canal of Wirsung, either implant it in the jejunum as is done with the common duct, or bury the cut surface of the pancreas in the jejunal loop, that is, exclude it from the alimentary circulation. After transepiploical drainage of the pancreatic region the abdominal wall is closed.— *Technique de la pancréatectomie. Revue de Chirurgie*, 1907. AIMÉ PAUL HEINECK, M.D.

THE LIGHTENING TREATMENT (BLITZBEHANDLUNG) OF CANCER. By Professor Czerny.

This contribution to the treatment of cancer comes from the cancer institute at Heidelberg and, if on no other grounds than this, merits notice. The method of "blitzbehandlung," or, as Czerny calls it, "fulguration," seems to differ in no way from the ordinary, high frequency current application, the theory of which is fully explained by the author, who also clearly illustrates the technique and pathological results, by means of drawings. Czerny claims the method to be less bloody than radical operation, and therefore more acceptable to patients. The method should be reserved for those cases of superficial ulcerative cancer of the skin or mucous membranes, and even in these cases it is not certain whether recurrence will not take place. He believes the method to be safer and quicker than the X-ray or radium, but reserves judgment as to whether it will ever be adaptable to deep-seated neoplasms. In cases of recurrent carcinoma, the method allays pain, hæmorrhage, and suppuration, and may even favor healing, but the effects in just such cases may be undesirable, by reason of the fact that in some cases pain is increased and cachexia hastened.— *Münch. Med. Woch.*, Feb. 11, 1908. M. G. SEELIG.

RUPTURE OF THE SPLEEN. Ry Raoul Baudet.

The patient, laparotomized 32 hours after an injury, had a transverse rupture of the spleen; the inferior fragment being completely torn off, the spleen was removed. Recovery.

After rupture of the spleen, there is a latent period of about 20 hours duration in which the symptoms are vague, are indefinite.

The fact that the patient has received a violent traumatism in the left hypochondriac region, and that he has had a few fainting spells is suggestive of splenic injury. Abdominal distention and abdominal tenderness are other suggestive symptoms. All these facts lead us to think of possible injury to the viscera, and incite us to do an exploratory laparotomy. In the presence of serious intraabdominal hæmorrhage, we can not content ourselves with hæmostatic measures of doubtful value. The spleen must be extirpated. The spleen, however, is not always accessible; it is, at times, deeply situated beneath the diaphragm, adherent, having a small pedicle.

The operator to gain access to the spleen employs the following technique: An oblique incision is made along the left costal arch, the abdominal cavity is opened at this point. He incises the eighth costal cartilage near the sternum, above and near the costal chondral articulation below. Lower down, the ninth costal cartilage is incised. This makes a flap which, after being turned up, gives a fairly good view of the spleen, of the diaphragm, and of the superior portion of the stomach.— *Rupture de la Rate. Médicin Practicien*, 1907.

AIMÉ PAUL HEINECK, M.D.

A CONTRIBUTION TO SPLENECTOMY. By J. Perez.

The distal results of splenectomy are important to determine. Perez, in a patient with an enlarged spleen, made a complete physical examination as well as an examination of the different secretions of the body. He then performed splenectomy. This was a patient in the beginning of Banti's disease. Long after the splenectomy, after the patient's convalescence, he could detect no hepatic or pancreatic disturbance, but the patient had frequent attacks of hyperthermia. The author discusses at length, the changes in the blood that have been noted after splenectomy. In another case of splenectomy, which has had repeated examinations of the blood, after the operation showed a diminution in the number of red blood corpuscles, and an increase in the number of white blood corpuscles. The toxicity of the urine was slightly diminished. These facts show that the spleen has multiple functions; it is hæmatopoietic, lymphopoietic. It has also an antitoxic and an antibacterial function.— *Contribution á la Splénectomie. Archives générales de Chirurgie*, 1907. AIMÉ PAUL HEINECK, M.D.

ENDO-ANEURYSMORRAPHY (MATAS) IN THE TREATMENT OF TRAUMATIC ANEURISM OF THE FEMORAL ARTERY. By J. M. Elder, M. D., of Montreal.

Case. False aneurism caused by injury of the femoral artery, in puncture wound of the right leg, just above and to the inner side of the popliteal. Aneurism developed about one month after injury.

Operation. Vertical incision made over the tumor. Esmarch constrictor applied above incision. False aneurism evacuated and when field was dry, the small opening (5 x 2.5 mm.) was closed with 3 sutures of fine silk, a small round curved needle being used and care being taken to include

the intima. Cigarette drainage removed in 48 hours, there being no oozing. Recovery complete. —*Annals of Surgery*. February, 1908.

WM. R. CUBBINS.

TORSION OF THE GREAT OMENTUM. By F. Lejars.

Twists of the omentum are not uncommon and the author insists upon the relations existing between omental torsions and inguinal hernias. In one class of cases, omental torsion is associated with an irreducible hernia. The descent of the omentum in the hernial sac, its adhesions to this hernial sac, its chronic inflammation — all these factors favor omental torsions. These omental twists may be below, that is, within the sac (parasaccular); above or near the colon (paracolic). Frequently, they are double. In the parasaccular forms of torsion, the diagnosis usually made, is that of a strangulated epiplocele. More interesting is the diagnosis of the paracolic forms. Acute torsion is associated with acute onset of pain, first hernial in location, then abdominal. The hernia is distended, painful. The careful examination of the abdomen reveals a voluminous abdominal tumor which has indefinite contours and an irregular nodular surface. The hernial and the abdominal tumor present the same characteristics.

In a second series of cases, the omental torsion is associated with an empty hernial sac. The clinical symptoms are those of a suppurative appendicitis. The diagnosis is made only after a laparotomy. Very uncommonly the omental twist may occur in individuals without a hernia. It may be secondary to the development of a neoplasm in the free border of the omentum. It may be due to adhesions binding the omentum to a pelvic tumor. The diagnosis is, in such cases, very difficult. Nevertheless, the rapid development, the volume, and the consistency of the tumor are suggestive.

Omental twist demands an early surgical intervention. Only in the recent cases is it sufficient to untwist the omentum. As a general rule, the omental mass must be removed. Careful ablation of the tumor, ligation of the pedicle, which must always be made in healthy tissue, resection — such are the different steps of the operation, the results of which up to this date have been satisfactory.— *Les Torsions du grand épiploon. Semaine médicale*, 1907.

AIMÉ PAUL HEINECK.

NON-PERFORATIVE PERITONITIS IN THE COURSE OF TYPHOID FEVER. By Roy.

Peritonitis may be due to a migration, to the passage through the intestinal wall of the microbe organisms contained in the digestive tube and the virulence of which has been increased in the intestinal canal.

The particular exciting agents of this condition are the bacillus of Ebert and the bacterium coli.

It is not a common complication. The condition may be latent because the functional symptoms which it causes are obscured by the marked prostration, inherent to typhoid fever, and by the slow and torpid evolution of the peritoneal reaction. When the symptoms are marked the condition simulates various diseases and accidents: appendicitis, intestinal perforation, etc. In general, peritinitides, due to a perforation, or to propagation, present almost identical symptoms. A differential point of diagnosis is the persistence or the disappearance of the area of the hepatic dulness.

The etiological diagnosis of typhoidal peritonitis is always a difficult problem, most always it has been determined only in the course of an autopsy or of an operation. In cases of circumscribed peritonitis, of slow evolution, the diagnosis of peritonitis due to propagation can be made and medical treatment may be instituted; opium, rest, suspension of the baths, ice bag upon the abdomen, and even ingestion of nucleinate of soda. But if we are dealing with a generalized peritonitis, the cause of which we cannot determine, (propagation or perforation), the only recourse which affords any chance of cure is laparotomy. It is probable that propagation peritonitis, circumscribed in type, is not uncommon in typhoid fever. We ask ourselves whether some of the cases of intestinal perforation, that have been reported as recovering spontaneously, were not cases of circumscribed propagation peritonitis. We have met cases of intestinal perforation in typhoid fever, in which the profuse formation of adhesions, due to the ulcerative process which preceded the perforation, prevented by circumscribing them, the escape of intestinal contents into the general peritoneal cavity and the development of a diffuse subacute generalized peritonitis.— *Les péritonites par propagation au cours de la fièvre typhoide. Archives générales de Chirurgie*, 1907.

AIMÉ PAUL HEINECK.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF GYNECOLOGY

UNDER THE CHARGE OF

J. Clarence Webster, M. D.
J. C. Hollister, M. D.
Gerry R. Holden, M. D.
E. C. Dudley, M. D.
F. W. Lynch, M. D.
Carey Culbertson, M. D.

Backward Displacement of the Uterus. By G. Bellingham Smith.

In a somewhat lengthy paper on this subject Smith arrives at the following conclusions:

1. Many cases of backward displacement are unattended by symptoms and need no treatment.

2. Some are congenital and have symptoms that are not referable to the displacement, namely, dysmenorrhœa and sterility. These call for a different line of treatment.

3. Where enlargement and tenderness of the uterine body exists, and there is a difficulty in immediate replacement, treatment, with a view to reducing congestion, had best be carried out. The same preparatory treatment would apply to those cases in which the ovaries are prolapsed.

4. When well-marked symptoms of neurosis are present, it is advisable to consider carefully how far the local condition is responsible for them. Treatment in these cases is likely to be somewhat of an experiment.

5. When the uterus is bound down by adhesions, persistence of symptoms, in spite of treatment, will justify an operation for the freeing of adhesions and fixation forward of the uterus.

6. Ventral and other methods of fixation of the uterus are called for in a small minority of cases of backward displacement. Owing to the risks involved in the operation itself, and from subsequent pregnancy, it should be undertaken only when other measures of relief have failed.— *The Practitioner*, vol. lxxix, No. 2, August, 1907.

Carey Culbertson.

Shortening of the Round Ligaments for Backward Displacement of the Uterus. By. J. W. Taylor.

Taylor, of Birmingham, bases this paper on a personal experience of 85 cases, using a modification of the Alexander operation. As regards contraindications, the author states than any intraperitoneal disease, especially any kind of adhesion, is an indication against operation by this method — abdominal or vaginal section being preferable. Some prolaspe of one or both ovaries, even with a little enlargement, is no contraindication, some of the most happy results being obtained in cases of backward displacement with this as an additional feature. The uterus, which is generally slightly enlarged, and the subject of some chronic endometritis, is dilated and well curetted, and placed in complete anteversion, with a well-fitting pessary in place. The incisions are those used in the typical Alexander operation and, after being dissected out, the round ligament is pulled out until one sees the fold of peritoneum near its uterine attachment. Closure of the ring is begun by taking up, with a fine silk thread, the pillars at their highest point and tying them together so as to obliterate the weak space there. Then a continuous suture is carried down, including in each stitch the pillar of each side with the upper part of the round ligament between. A through-and-through stay-suture of silk-worm gut is passed down as far as the aponeurosis, and then the closure of the ring is completed with the continuous silk. The ligament is then returned within the wound and the latter is closed with two additional silk-worm gut sutures.

The 85 cases were all double, making 170 operations in all. Taylor's results are as follows: 1. There was no mortality; 2. In 15 or 16 cases there was some slight suppuration, but in all the rest healing was by first intention; 3. There were no complications due to the operation, save one case of hernia, occurring in his earlier practice; 4. With six exceptions he has been able to follow up the after history of all the patients, with any indication of relapse in only three; 5. In 14 cases, 19 pregnancies have followed without difficulty, 2 cases resulted in early miscarriage, and all of the 14 patients had been completely or relatively sterile before operation. Two of the cases of partial failure or relapse occurred after confinement; 6. In three cases, complicated with ovarian prolapse and pain, all did well and preg-

nancy followed in one; 7. In two cases amputation of the cervix due to hypertrophic elongation was performed; in one of these where there had been dyspareunia, pregnancy followed with an easy and successful issue. Other coincidental operations were occasionally performed, such as repair of the perineum, fixation of the kidney, removal of a fibroid polypus, hæmorrhoidectomy, etc. Inguinal hernia was a co-exsiting condition accepted as additional reason for the operation in two cases. 8. Two cases subsequently developed appendicitis, and one a tubal pregnancy.— *Jour. of Obst. and Gyn. of the Brit. Emp.*, Dec., 1907.

CAREY CULBERTSON.

CHORIONEPITHELIOMA. By Thos. Watts Eden.

After describing a case of chorionepithelioma in most respects fairly typical of its class, clinically and histologically, the author reviews the theory regarding the formation of this tumor. He cites the case of Pick and that of Devitsky, where pregnancy did not seem to be a factor, and from these comes to the conclusion that it is possible that chorionepithelioma of teratomatous origin may also occur in the female, and that, if this is possible, pregnancy is no longer to be regarded as the necessary antecedent of the disease in woman. "Chorionepithelioma is a form of malignant growth which occurs in both sexes; it is very much more frequent in women than in men, and pregnancy is its most potent predisposing cause; in women it naturally arises from fragments of chorionic tissue — normal or abnormal — which have been retained from a previous pregnancy; it may, however, occur in women independently of previous pregnancy, and in such cases its origin cannot, at present, be explained. In men, it is generally, perhaps invariably, of teratomatous origin." — *Jour. of Obst. and Gyn. of the Brit. Emp.*, Dec., 1907.

CAREY CULBERTSON.

A CASE OF "INTRALIGAMENTARY" URINARY BLADDER. By W. E. Fothergill.

TWO CASES OF "INTRALIGAMENTARY" BLADDER. By T. Arthur Helme.

Fothergill's case is that of a young woman who had suffered with frequency of micturition for years, accompanied by a pronounced neurasthenia. For five years there had been intense pain in the left iliac region and hip whenever one or two ounces of urine had collected in the bladder. The urine was normal and there was no sign of any infective condition. Sedatives had no effect. Examination of the bladder and urethra revealed no disease. The uterus could not be retroverted and seemed to be fixed rather definitely to the bladder. The appendages were apparently normal. Upon examination by abdominal section, it was seen that the peritoneum passed directly from the fundus to the bladder, without forming a uterovesical pouch. The bladder thus reached to the upper limits of the broad ligaments in the middle line, and extended into them on each side. A uterovesical pouch was made in this case by plastic peritonization with very satisfactory results.

Helme's first case is that of a woman who underwent abdominal hysterectomy for carcinoma of the cervix uteri. On opening the peritoneal cavity, it was at once noticed that the uterovesical pouch was absent. The greater portion of the bladder lay within the folds of the right broad ligament, so that it was only after tedious and difficult dissection that the bladder was freed, and the hysterectomy accomplished. A few hours later five ounces of urine was withdrawn, but within twenty-four hours the patient's condition was such that the entire wound was opened. The ureters were distended, especially on the right side. Division of the left occurring, it was implanted into the vaginal vault, death resulting six days later.

The second case reported by Helme is that of a woman who complained of urinary retention, with a swelling protruding through the vulva, and four months pregnant. Examination disclosed a tense, cystic swelling protruding through the vulva, the part outside being about the size of a full-time child's head. Its posterior surface was continuous with the posterior vaginal wall, which was everted. The abdomen was somewhat distended by a cystic swelling rising above the pubes. A catheter, passed into the bladder, allowed the escape of twenty ounces of urine, with the disappearance of the abdominal swelling, but there was no change in the appearance of the vulvar tumor. Under anæsthesia, however, considerable pressure, as in the effort to reduce hernia, caused fifty additional ounces of urine to be ejected through the urethra. It was now discovered that this cystic development occurred first in the pouch of Douglass, gradually pushing the posterior vaginal wall in front of it. As the swelling disappeared, it could be felt passing to the right of the retroflexed pregnant uterus. The patient had very little subsequent trouble, until in a second pregnancy almost the same condition recurred. While the condition was not verified by operation, Helme is satisfied that he had to do with an intraligamentary bladder, occupying the right broad ligament, so that the retroflexed gravid uterus pushed it back into the pouch of Douglass, where it became distended. — *Jour of Obst. and Gyn. of the Brit. Emp.*, Dec., 1907.

CAREY CULBERTSON.

ON PRIMARY AND SECONDARY DYSMENORRHEA. By Marie Tobler.

Tobler bases her study on 700 cases of dysmenorrhea, most of which she observed at the gynecological clinic of Flesch, in Frankfurt. Of the 700 cases, 234 or 35 per cent, were primary, and 466, or 67 per cent were secondary.

Dysmenorrhea in unmarried girls is first considered. There are 556 cases. In 42 per cent of them the dysmenorrhea was in existence since the first period (primary dysmenorrhea). In 58 per cent the periods were at first painless, the dysmenorrhea appearing later (secondary dysmenorrhea).

From an analysis of the histories of the cases of primary dysmenorrhea, it is found that the patients are often affected by some constitutional trouble (chlorosis, scrofula, incipient phthisis, etc.). The onset of menstruation was often either earlier or later than usual. Many of these girls took up some very laborious or confining occupation before puberty. Chronic constiptation is also frequently present.

There are 154 cases of unmarried girls with secondary dysmenorrhea. Only a few patients give definite factors to account for the beginning of their dysmenorrhea (catching cold, bodily trauma or over-exertion, psychic shock, etc.). The patients are frequently found to have poorly developed pelvic organs. Constipation, anæmia, unhygienic habits of life or work, are present in many instances, together with circulatory disturbances on account of tight lacing.

In studying the duration of the pain in these cases, both primary and secondary types, 402 patients gave histories which were of value. The pain was premenstrual in 71 cases; lasted the first few hours or the first day in 150; lasted for two or three days in 49; premenstrual and first day in 70; premenstrual and several days in 15; variable in 47. The essential feature being that it is often premenstrual, with the climax during the first few hours of flow. Most patients describe the pain as constant, not of the type of labor pains, using such expressions as "drawing," "dull," or "cramplike" to describe it. Others liken it to intestinal colic. It has a widespread distribution, being located not only in the abdomen, but in the lumbar, sacral and inguinal regions and thighs.

Pelvic examination in unmarried women very rarely shows abnormalities which can account for the symptom. In some of the patients moveable retrodisplacements were found, but they were apparently of little significance. Inflammatory conditions are rare in virgins. Pathological anteflexion was found but once.

The clinical course of the trouble over a number of years was studied in limited number of cases. It is found that primary dysmenorrhea in young girls is more apt to undergo a spontaneous cure than the secondary type. On the other hand, secondary dysmenorrhea of multiparæ is more frequently cured or improved by a subsequent labor than is primary dysmenorrhea. It is found that 64 per cent of both groups are cured or improved by childbirth.

As an explanation for the cause of dysmenorrhea in young girls, Tobler desires a theory which shall explain most rationally the various phenomena above mentioned. The mechanical theory applies to but a few cases. Moreover, we cannot account for the large number of cases of secondary dysmenorrhea by the mechanical theory. The inflammatory theory also is not applicable to dysmenorrhea of such patients. To ascribe a nervous origin to this variety is unreasonable. The majority of these cases are psychically entirely normal between the menstrual periods. Such an explanation is not supported by clinical evidence.

The clinical phenomena are best explained by assuming an abnormal hyperæmia, either active or passive, of the pelvic organs at the time of the period. Passive hyperæmia may be caused by unhygienic habits and methods of living, by improper clothing, and constipation. Active hyperæmia is caused by over-exertion. When this hyperæmia is associated with a poor development of the uterus, pain may be caused by stretching of the nerves. The principal seat of pain, however, lies in the plexuses of nerves and vessels in the subperitoneal and pelvic connective tissue. The vessels become engorged and distended, putting the nerve filaments under abnormal tension.

This theory is supported by a study of the varying clinical manifestations of dysmenorrhea. Moreover the ordinary treatment of dysmenorrhea, which is simply efforts to relieve pelvic congestion, supports it.

Dysmenorrhea which appears first after marriage or childbirth has a different clinical aspect. In the great majority of cases pathological changes in the pelvic organs are present. However, it may still be a question whether or not such anatomical changes should be accepted as the sole explanation of the symptom. Even here it may be that circulatory disturbances are the most important factors.— *Monatsschrift für Geburtshülfe und Gynäkologie*, bd. xxvi, h. 6, Dez., '07. GERRY R. HOLDEN.